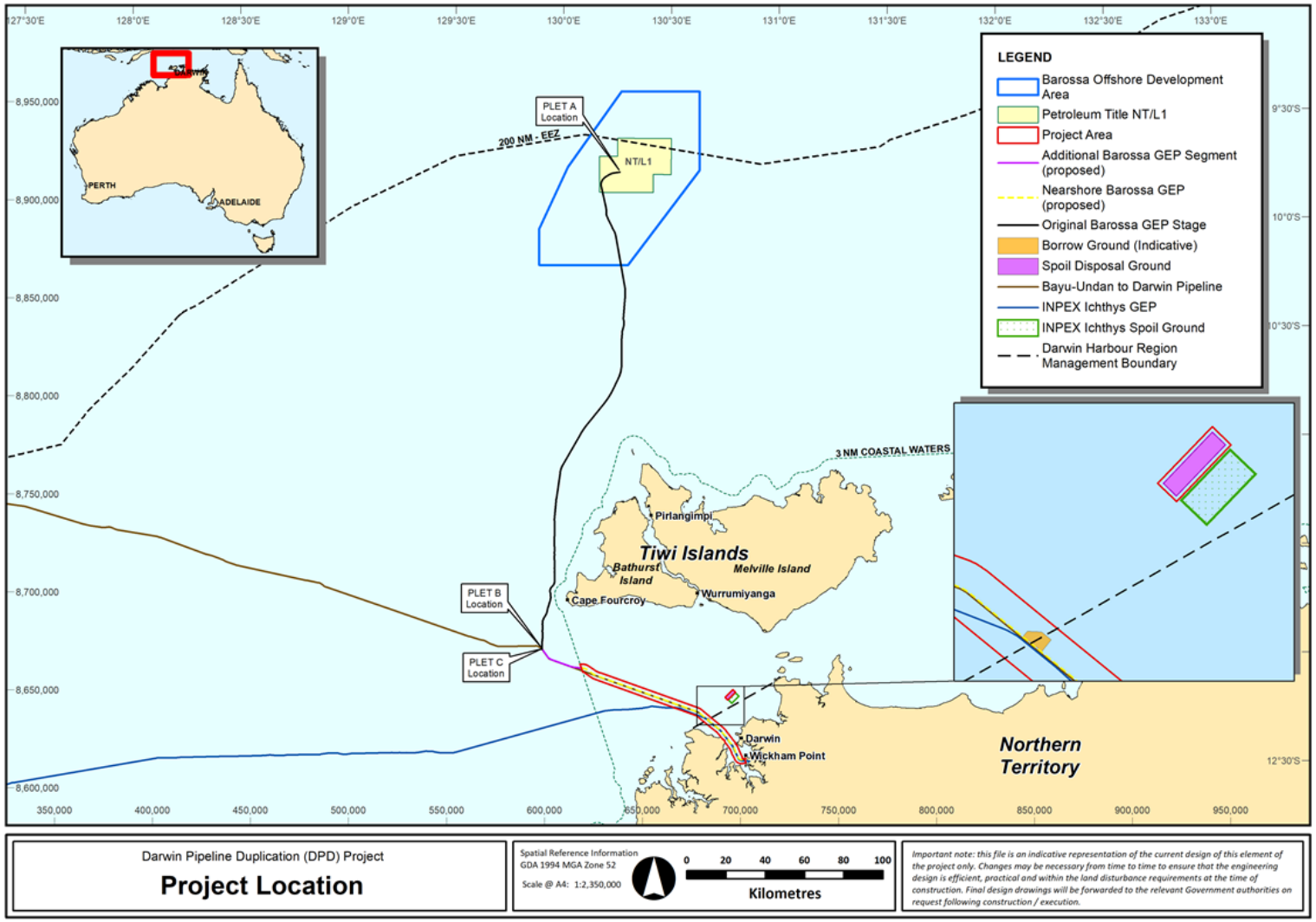
Appendix A – Darwin Pipeline Duplication (DPD) Project Overview Figure



Darwin Pipeline Duplication (DPD) Project

Project Location

Spatial Reference Information
GDA 1994 MGA Zone 52

Scale @ A4: 1:2,350,000

0 20 40 60 80 100
Kilometres

Important note: this file is an indicative representation of the current design of this element of the project only. Changes may be necessary from time to time to ensure that the engineering design is efficient, practical and within the land disturbance requirements at the time of construction. Final design drawings will be forwarded to the relevant Government authorities on request following construction / execution.

NT Legislation

Legislation	Government Department	Summary of Environmental Legislation
Darwin Port Corporation Act 2015 and Port By-Laws	Darwin Port Corporation	Clause 16. Functions of Darwin Port Corporation. Darwin Port Corporation is responsible for the movement of all vessels within the Port limits. Port officers act as Agents for the prevention, management and control of pollution by oil in this jurisdiction. Clause 29. Directions for movement and control of vessels within the Port, including traffic, mooring and anchoring of vessels. Consideration of this Act and By-Laws will be required to plan vessel movements, trenching and pipelaying works, spoil disposal and establishment of a Precautionary Zone for the protection of the pipeline.
Energy Pipelines Act and Regulations 2015	Department of Industry, Tourism and Trade (DITT)	The Act provides for the construction, operation, maintenance and cessation of use or abandonment of pipelines for the conveyance of energy-producing hydrocarbons, and for related purposes. Part III of the Act details the requirements for renewal and variation of pipeline licences. The Regulations outline the consent requirements to operate, modify or decommission pipelines, and the content requirements of a Pipeline Management Plan to manage pipeline related activities. A licence to operate the pipeline will be required for the Project. This will require the development of a Pipeline Management Plan.
Fisheries Act 1988	DITT – Fisheries Division	The Act makes it illegal to pollute waters where the effect of the substance is that fish or aquatic life are injured, detrimentally affected or the habitats, food or spawning grounds are detrimentally affected. Consideration of this Act is required in the assessment of potential impacts and mitigation measures for the construction of the pipeline.

Legislation	Government Department	Summary of Environmental Legislation
Heritage Act 2011 and Regulations 2012	DITT	The Act provides for the conservation of the NT's cultural and natural heritage. The Heritage Council established under the Act makes assessments and regulate work on heritage places. All sites on the NT Heritage Register and yet to be discovered sites are protected under this Act. Heritage values include both marine and terrestrial. Heritage values will be identified and avoided as part of the Project development plan.
Marine Pollution Act 1999 and Regulations 2003	Department of Environment, Parks and Water Security (DEPWS)	The objective of the Act is to protect the marine and coastal environment from ship/boat sourced pollution. This includes litter/ rubbish, hydrocarbons and substances that may be hazardous to the marine environment (including substances that may be in ballast and grey water). All marine activity during the Project development will adhere to the requirements of this Act.
Northern Territory Aboriginal Sacred Sites Act 1989 and Regulations 2004	Aboriginal Areas Protection Authority (AAPA)	The Act depicts the need to preserve and promote Aboriginal tradition in relation to land in the NT. This Act establishes procedures for the protection and registration of sacred sites. The Act establishes offences for entry onto, work on or, desecration of, sacred sites without appropriate certification or in contravention of the certification. This Act creates the Aboriginal Areas Protection Authority (AAPA), which issues (Sacred Sites) Certificates for specific areas. These certificates advise of sacred sites within an area. Approval must be sought and obtained before sacred sites can be disturbed or destroyed. An Aboriginal sacred sites survey of the DLNG facility site was conducted prior to clearance for construction. Sites remaining in situ are marked and must not be disturbed. A survey for Aboriginal sites must be conducted prior to any future site clearance work. Through consultation with the AAPA as part of pre-referral engagement, it has been confirmed that an AAPA Certificate for the DPD works is required. Santos is in the process of preparing an application to AAPA, at the time of this referral.

Legislation	Government Department	Summary of Environmental Legislation
Planning Act 1999 and Regulations 2000	Department of Infrastructure, Planning and Logistics (DIPL)	The Act provides framework of controls for the orderly use and development of land. The objective of the Act includes ensuring that strategic planning is applied to planning schemes and implemented in individual planning decisions, promotion of sustainable development of land and promotion of the responsible use of land and water resources to limit the adverse effects on development of ecological processes. Division 2 of the Act provides the planning basis for the submission, review and authorisation of Exceptional Development Permits (EDPs), and related EDP variations. An EDP has been issued for the DLNG facility to which the Project will tie-into.
Territory Parks and Wildlife Conservation Act 1976 and Regulations 2001	DEPWS	The Act forms a framework for the establishment and management of parks and reserves and declaration of protected wildlife. This Act has been considered with regard to the potential interactions with protected wildlife.
Waste Management and Pollution Control Act 1998	DEPWS	The Act protects the environment through the encouragement of effective waste management and prevention and control practices of pollution. Section 30 of the Act specifies that certain activities undertaken in the Northern Territory require an Environment Protection Licence (EPL). The DLNG facility operates under EPL217-02. Management of waste and discharges during the Project construction will be in compliance with this Act.
Water Act 1992	DEPWS	An Act to provide for the investigation, allocation, use, control, protection, management and administration of water resources, and for related purposes. Under this Act, the waters of Darwin Harbour (and the marine reaches of rivers draining into it) were declared to have “beneficial uses” for the protection of aquatic ecosystems, recreational water quality and aesthetics. It is an offence under this Act to pollute the declared waterways and impact on the beneficial uses.

Legislation	Government Department	Summary of Environmental Legislation
		Section 74 of the Act delegates powers to the NT EPA Chair to grant waste discharge licences for discharge of waste to water. An Application for a Waste Discharge Licence (WDL) is required for discharges, such as hydrotest/dewatering, dredging and spoil disposal, to Darwin Harbour and creeks or rivers draining into the Harbour.
Weeds Management Act 2001 and Regulations	DEPWS	An Act to prevent the spread of weeds in and out of the Territory, and to ensure that the management of weeds is an integral part of land management. Management of weeds for this Project will be in compliance with this Act.

Commonwealth Legislation

Legislation	Government Department	Summary of Environmental Legislation
Australian Heritage Council Act 2003	Department of Agriculture, Water and the Environment (DAWE)	This Act identifies areas of heritage value listed on the Register of the National Estate and sets up the Australian Heritage Council and its functions.
Environment Protection (Sea Dumping) Act 1981	DAWE	The Sea Dumping Act implements Australia's obligations under the London Protocol, which aims to prevent marine pollution by dumping of wastes and other matter. The Act applies in all Australian waters, except areas determined to be within the limits of a State or of the NT. Therefore, States and the NT can legislate to control sea dumping in their adjacent three nautical miles of sea if State/Territory legislation conforms with the Sea Dumping Act (Section 9 of the Act). As such, if a spoil disposal ground is required for the DPD project and it is located within NT waters, the Sea Dumping Act does not apply; thereby negating the need for a sea dumping permit. The NT EPA have published guidelines for the environmental assessment of marine dredging, which cover spoil grounds (NT EPA, 2013). Therefore, in NT Territorial waters, approvals for spoil ground placement and disposal, is within the remit of Northern Territory jurisdiction.
Historic Shipwrecks Act 1976 and Historic Shipwrecks Regulations 1978	DAWE	This Act protects shipwrecks that have lain in territorial waters for 75 years or more. It is an offence to interfere with any shipwreck covered by the Act.
National Greenhouse and Energy Reporting Act 2007 National Greenhouse and Energy Reporting Regulations 2008	Clean Energy Regulator	The National Greenhouse and Energy Reporting Act 2007 (NGER Act) provides a single national framework for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy production and energy consumption, and for other purposes. The safeguard mechanism requires businesses that have facilities with direct emissions of >100,000 tonnes of carbon dioxide equivalence a year to keep net emissions at or below baseline emissions levels.

Legislation	Government Department	Summary of Environmental Legislation
National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 Emissions Reduction Fund and associated Carbon Credits (Carbon Farming Initiative) Rule 2015 (established under the Carbon Credits (Carbon Farming Initiative) Act 2011)		Emissions Reduction Fund (ERF) incentivises Australian businesses to reduce the amount of greenhouse gas (GHG) emitted and promotes activities that store carbon. Eligible projects can earn Australian Carbon Credit Units (ACCUs) for every tonne of emissions reduced or stored through a project.
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) and Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations) Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 Offshore Petroleum and Greenhouse Gas Storage (Resource Management	NOPSEMA	The OPGGS Act provides protection of the environment in Commonwealth waters (as well as designated State and NT waters where functions have been conferred) through ensuring that all offshore petroleum and greenhouse gas storage activities are undertaken in a manner where impacts on the environment, including those Matters of National Environmental Significance (MNES) protected under Part 3 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), are of an acceptable level and reduced to 'as low as reasonably practicable' (ALARP). The Act provides for the granting or renewal of pipeline licences while the regulations facilitate the regulation of environmental and safety management of offshore petroleum and greenhouse gas pipelines. The Commonwealth waters section of the Project is being addressed through an Environment Plan Revision to the existing Barossa GEP EP, to be submitted separately to NOPSEMA under the OPGGS (E) Regulations.

Legislation	Government Department	Summary of Environmental Legislation
and Administration) Regulations 2011		
Underwater Cultural Heritage Act 2018		Provides for the protection of shipwrecks, sunken aircrafts and ither types of underwater cultural heritage within Australian waters, and is relevant to the underwater cultural heritage values within Darwin Harbour.

Existing environmental approvals relevant to the Project

Approval	Summary
DLNG Development Approvals	
DLNG Facility Environmental Impact Statement (EIS)	The DLNG Facility was assessed under an EIS by the Northern Territory Environment Protection Authority (NT EPA) under the Northern Territory (NT) Environmental Assessment Act 1982 and approved under a set of recommendations in February 1998. The scope of the EIS comprised a single liquefication train to produce liquefied natural gas (LNG) up to 3 million tonnes per annum (MTPA) and consideration of the effects of potential future expansion to an LNG facility of 9 MTPA nominal capacity. It was recommended that any revised proposal for future expansion b submitted to the NT Government for further assessment under the NT Environmental Assessment Act 1982.
DLNG Public Environmental Report (PER)	A revised proposal was submitted to the NT EPA under the NT Environmental Assessment Act 1982 in March 2002, for expansion to a maximum 10 MTPA facility, comprising two LNG trains, each with a maximum output of 5 MTPA. The revised proposal also allowed for gas to be sourced from a number of Timor Sea gas fields (including the Barossa Field), in addition to the Bayu-Undan Field, as nominated in the approved EIS. The revised proposal was assessed as a PER and concurrently reviewed under the Administrative Procedures approved under the Commonwealth Environment Protection (Impact of Proposals) Act 1974 (now repealed and replaced by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)).
Exceptional Development Permit	The DLNG (10 MTPA) Exceptional Development Permit (EDP) (02/0015) was issued by the NT Minister for Lands and Planning on 11 November 2002 for development of the facility in two stages. The EDP provides conditions for air emissions, emergency response, flora and fauna management, waste management, water and wastewater management, heritage protection requirements and visual amenity considerations (ConocoPhillips, 2019a). Subsequent variation permits have been issued, and currently the permit is operated under EDP02/0015G (issued in November 2016).
Barossa Development Approvals	
Barossa Area Development Offshore Project Proposal	ConocoPhillips (now Santos) submitted an Offshore Project Proposal (OPP) for development of the Barossa Field. The OPP included the in-field infrastructure in the Barossa Field, including a Floating Production Storage and

Approval	Summary
	Offloading (FPSO) facility and supporting in-field subsea infrastructure, and a new approximately 260 km subsea gas export pipeline (GEP) that connected into the existing operational Bayu-Undan to Darwin pipeline (at Kilometre Point (KP) 380). The Barossa development will backfill Darwin LNG when the Bayu-Undan to Darwin pipeline ceases production. The OPP was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in March 2018.
Original Barossa GEP Stage Installation Environment Plan (EP)	The original Barossa GEP Stage Installation EP identifies and evaluates the potential environmental impacts and risks associated with the installation of the Original Barossa GEP Stage in Commonwealth waters. The pipeline installation activities addressed in the EP consist of: + pre and post lay surveys; + pre and post lay span rectification; + installation of the gas export pipeline and end terminals, including foundations, flooding, cleaning, gauging and testing, dewatering; and + pipeline pre-conditioning activities. A revision of the original Barossa GEP Stage Installation EP introducing a new stage of the Gas Export Pipeline (e.g. the additional Barossa GEP segment in Commonwealth Waters is being prepared at the time of submitting this referral.
Barossa Future Activities EP	Santos will be required to submit a series of EPs to NOPSEMA to enable the development of the Barossa Field. Currently, the Development Drilling and Completions EP has been submitted and the original Barossa GEP Stage Installation EP (already accepted by NOPSEMA, as per above) is currently being revised to include the section of the DPD Project within Commonwealth Waters (e.g. additional Barossa GEP segment). It is anticipated the EPs for the future activities will be packaged as follows: + Moorings Installation EP; + Subsea Umbilicals Risers and Flowlines Installation and Pre-commissioning EP; + FPSO and Operations EP; and + Barossa GEP Start-Up and Operations EP.

Approval	Summary
Operational Approvals	
Bayu-Undan GEP Operations EP	ConocoPhillips (now Santos) submitted an EP to NOPSEMA for activities associated with the operation and maintenance of the Bayu-Undan to Darwin pipeline to comply with the OPGGS(E) Regulation 11(1) and the NT Energy Pipelines Act. The pipeline is a dry natural gas export pipeline that transports gas from the Bayu-Undan Field, located in Timor-Lesté waters, to the DLNG facility. The pipeline overlaps three jurisdictions and has several associated pipeline licences, these being: Timor-Leste waters (BU-1-PL), Commonwealth waters (WA-8-PL and NT/PL1) and NT coastal waters (PL20 and NTC/PL1). The Bayu-Undan GEP Operations EP was accepted by NOPSEMA in February 2019.
DLNG Operations Environmental Management Plan (OEMP)	The DLNG OEMP defines the battery limits of the facilities and details the credible environmental risks and risk management controls associated with the operation of the DLNG facility. The OEMP is updated every five years, at a minimum. The last update of the OEMP was undertaken in August 2018 as part of the five year review cycle.
Environment Protection Licence (EPL)	The EPL is issued under Section 34 of the NT Waste Management and Pollution Control Act 1998. The EPL is required for DLNG as it is an operating premises for processing hydrocarbons so as to produce, store and/or dispatch liquefied natural gas or methanol in excess of 500,000 tonnes annually. The DLNG EPL-LNG 01 was issued by the Executive Director of the NT EPA on 9 December 2005 for the production of LNG and natural gas liquids at the DLNG production plant at Wickham Point, with nameplate production capacity equivalent to 3.7 MTPA. Subsequent licences have been issued, with the last being issued in July 2018 (EPL 217-02).
DLNG Transition Work Program Notice of Intent (NOI)	A NOI for the DLNG Transition Work Program was submitted to the NT EPA for assessment in October 2019 to determine whether or not formal assessment is required pursuant to the NT Environmental Assessment Act. The NT EPA decided that the potential environmental impacts and risks associated with the work program did not warrant environmental impact assessment by the NT EPA at the level of a PER or EIS. The scope of the NOI included the modification and refurbishment of the current DLNG facilities to support the new feed gas supply and extend operation of the DLNG beyond its original design life to approximately 2050. The DLNG Transition Work Program comprises two key phases; a transition period, followed by future (extended) operations to approximately 2050. In the transition period, production will cease from the existing Bayu-Undan gas supply and the facility will be on warm standby prior to introduction of the new gas supply. The transition period is

Approval	Summary
	an enabling window for key work scopes to be completed to ensure the DLNG facility is ready for continued operations with the new feed gas supply.

Appendix C – Stakeholder Engagement Plan

Darwin Pipeline Duplication (DPD) Project – Stakeholder Engagement Plan

PROJECT / FACILITY	DPD
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NO

Rev	**Owner**	**Reviewer/s** *Managerial/Technical/Site*	**Approver**
0	Barossa Stakeholder Adviser	Barossa Environmental Approvals Adviser	Barossa HSE Manager

Any hard copy of this document, other than those identified above, are uncontrolled. Please refer to the Santos Offshore Business Document Management System for the latest revision.

Contents

TABLES

1 Introduction

1.1 Project Summary

Santos' Darwin Pipeline Duplication (DPD) Project will enable natural gas from offshore reservoirs to be exported to the existing Santos Darwin Liquefied Natural Gas Facility (DLNG) with minimal environmental and social impact. Similar gas export pipeline developments have been successfully managed in the Northern Territory, and there is a significant body of knowledge available that provides confidence in the environmental assessment and management effectiveness.

Importantly, executing the DPD Project in a timely manner preserves the existing Santos Bayu-Undan to Darwin Pipeline for re-purposing opportunities into the future including carrying carbon dioxide for offshore carbon capture and storage (CCS). This opportunity will help Santos meet its emission reduction targets and achieve net-zero Scope 1 and 2 absolute emissions by 2040.

Santos' Darwin Pipeline Duplication (DPD) Project includes a ~23 km segment in Commonwealth waters (referred to as the 'Additional Barossa GEP Segment) and ~100-km segment in NT waters and lands (referred to as the 'Nearshore Barossa GEP'). The Project pipeline will be located parallel to the existing Bayu-Undan to Darwin Pipeline, to minimise potential environmental and social impacts.

The Referral supporting information document addresses the activities required to construct and operate the new pipeline segment in NT waters and lands only (e.g. the Nearshore Barossa GEP; herein referred to as the 'Project'). This document provides supporting information to the Referral Form for the DPD Project in NT waters and lands submitted under Section 48 of the NT Environment Protection Act 2019 to the NT Environment Protection Authority (NT EPA). The conclusion that the Project activities will have minimal impact and are readily manageable using well established pipeline construction and operational practices is based on the following:

- The Project is smaller in scale to previous gas export pipeline and marine infrastructure developments within Darwin Harbour.
- The Project is immediately adjacent to the existing Santos Bayu-Undan to DLNG Pipeline and the shore crossing is located within the existing DLNG disturbance footprint.
- There are a limited number of environmental factors requiring detailed assessment and focused management. These marine-based factors, as defined by the NT EPA, are Marine Environmental Quality, Marine Ecosystems and Coastal Processes. All other environmental factors are considered insignificant following a screening process, as presented within the document.
- There is a substantial body of location-specific scientific and management knowledge, with the key environmental and social values in the area being well understood. Santos has conducted recent environmental surveys to confirm the absence of sensitive or restricted environmental receptors along the Project pipeline.
- There is confidence in the effectiveness of the proposed management measures based on previous experiences and as validated by extensive environmental monitoring results.
- Proactive stakeholder engagement to ensure concerns and issues continue to be identified and effectively managed.

1.2 Purpose

This Stakeholder Engagement Plan (SEP) has been developed to create a structured process of engagement that sets out Santos's vision for engagement, guides Project team members on their engagement and enables Santos to articulate its commitments clearly and transparently to Government, community and other stakeholders.

The SEP will enable Santos to build an understanding of stakeholder values and concerns by creating meaningful opportunities for stakeholder participation from the early stages of preparation for the Project environmental referral.

Importantly, the Northern Territory Environment Protection Authority (NT EPA) obligates proponents to inform and seek community involvement, in a culturally appropriate manner, about potential environmental impacts and risks of a proposal. Section 3(d) and 3(e) of the *Environment Protection Act 2019* (EP Act) states the objects of the EP Act are to:

+ *"To provide for broad community involvement during the process of environmental impact assessment and environmental approval"; and*
+ *"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."*

Proponents must seek and document community knowledge and understanding of the area, including traditional Aboriginal knowledge, and use this expertise in identifying impacts and risks, and then planning for the avoidance or mitigation of those impacts and risks. As such, the stakeholder input received as a result of engagement stemming from this SEP has fed into the Project environmental assessment.

It is important to note the spatial and community context for which the Project is located. The Project is proposed in a pre-existing pipeline corridor subject to existing disturbance. It is in the Darwin Harbour and Middle Arm Peninsula and offshore marine environment in NT waters with direct stakeholder consultation predominantly focused on the users of these areas.

1.3 Outcomes and Objectives

1.3.1 Outcomes

Engagement for the Project is focused on achieving the following outcomes:

+ All identified key stakeholders are appropriately informed of the Project;
+ Stakeholders are provided with meaningful opportunities to participate in consultation for the Project;
+ Traditional Owners are provided opportunities for meaningful engagement and their culture and values respected; and
+ The Project specific environmental assessment has been actively informed by the input and feedback received from stakeholders.

1.3.2 Objectives

The SEP aims to achieve outcomes by:

- Creating a structured process focused on:
  - Building trust and mutual understanding between Santos and Project stakeholders
  - Addressing statutory stakeholder consultation requirements
  - Meaningfully engaging with stakeholders, specifically with regards to the environmental assessment and approvals process.
- Providing opportunities for Santos to understand stakeholder values and expectations;
- Embedding the importance of using local contractors and employees as much as possible throughout the Project;
- Ensuring that Traditional Owners and Indigenous groups are engaged;
- Securing stakeholder feedback that will be used as input for the environmental assessment process and to inform Santos' longer-term activities and community involvement; and
- Aligning with Santos' Corporate approach to stakeholder engagement.

1.4 Regulatory Requirements

As per the NT EPA environmental impact assessment guidance, proponents are responsible for undertaking stakeholder engagement and consultation from the earliest stage of the environmental impact assessment process and continuing throughout the process.

Santos is required to provide details of any stakeholder engagement and consultation undertaken to meet the requirements of section 43 of the EP Act and outline how this consultation has informed the assessment; including the environmental impact assessment, identification and management of impacts, and selection of offsets. Section 43 of the EP Act provide the general duty of proponents and states the following with regard to stakeholder consultation:

A proponent of an action has the following general duties under an environmental impact assessment process:

a. *To provide communities that may be affected by a proposed action with information and opportunities for consultation to assist each community's understanding of the proposed action and its potential impacts and benefits;*

b. *To consult with affected communities, including Aboriginal communities, in a culturally appropriate manner; and*

c. *To seek and document community knowledge and understanding (including scientific and traditional knowledge and understanding) of the natural and cultural values of areas that may be impacted by the proposed action."*

The NT EPA guidance related to stakeholder consultation focuses on an ongoing process of stakeholder engagement that involves building relationships, actively sharing information, and bringing stakeholder voices into decisions that may affect or interest them. The Project SEP has been prepared with this outcome as a key focus.

2 Engagement Approach

2.1 Overview of Approach

Santos is committed to undertaking projects in a manner that will both deliver on regulatory requirements and engage and contribute to the communities in which it operates. More broadly, Santos is focused on understanding and integrating those matters that will ensure the long-term outcomes aspired to by relevant stakeholders. The key focus will be on:

+ Governance and systems frameworks to support the business operations and how Santos works with stakeholders;
+ The formation of long-term, meaningful relationships and partnerships with stakeholders;
+ Alignment with relevant Northern Territory standards regarding stakeholder impact assessment, management and social investment; and
+ An active risk management approach and a focus on creating longer term value for the communities where Santos operates.

2.2 Principles for Project Engagement

In developing its approach for project engagement, Santos has referred to industry leading standards and practice including the Northern Territory Stakeholder Engagement and Consultation guidance (NT EPA, 2021a), Northern Territory guidance for preparing an environmental impact statement ((NT EPA, 2021b), the International Association for Public Participation's (IAP2) Quality Assurance Standard For Community and Stakeholder Engagement (IAP2, 2015) and relevant International Finance Corporation guides (IFC, 2007).

As outlined above, Santos actively builds community investment into its overall business and planning process. Engagement for this Project will be based on the following key principles:

+ Focusing on achieving genuine outcomes for communities;
+ Providing a flexible and proactive approach;
+ Being visible and transparent;
+ Where investment in communities is undertaken, supporting projects that encourage community self-sufficiency and sustainability; and
+ Enhancing social return on investment through strategic reviews of outcomes.

To achieve engagement objectives and outcomes it is important to define and explain the parameters of the Project including decisions that have already been made, decision-making processes and governance structures, statutory obligations and regulatory requirements. When Santos engages with stakeholders it is important that there is clarity regarding what can and cannot be influenced with regards to the Project. This is particularly important in terms of managing stakeholder expectations. The following points provide a frame of reference for what can and cannot be influenced.

2.2.1 What Can Stakeholders Influence

The following are identified as aspects stakeholders can influence:

+ How and when stakeholders are engaged across the Project lifecycle;
+ Identification of potential Project impacts through provision of local knowledge;
+ Considerations in the environmental assessment process and the supporting studies (e.g. information considered or assessed);
+ How Santos manages potential impacts (e.g. selection of control in accordance with the environmental decision-making process) and maximises potential opportunities/benefits;
+ The type and frequency of Project consultation they receive going forward; and
+ How Santos works with the local community and focuses on local priorities.

2.2.2 What Stakeholders Cannot Influence

The following are aspects stakeholders cannot influence:

+ The location of the Project;
+ The focus on achieving genuine outcomes for the local community, company workers and Santos shareholders; and
+ Approaches or requirements that must be implemented due to statutory obligations and regulatory requirements.

2.3 Engagement Undertaken to Date

Santos has undertaken initial engagement during Project planning and feasibility. The focus of initial engagement has been with key stakeholders, including government agencies, representative bodies regular Harbour users and the Port of Darwin where a significant portion of the project activities will be undertaken. A summary of consultation to date is provided in **Attachment 2**.

3 Stakeholders Analysis

3.1 Approach to Analysis

The analysis of stakeholders has been undertaken with a focus on understanding stakeholder values, understanding concerns and opportunities arising from the Project, and understanding potential impacts, risks, and levels of interest and influence. The intent of this initial analysis is to provide Santos with the foundation through which to inform the referral and continue engagement as the Project develops.

3.2 IAP2 Core Values

Stakeholder values are an important frame through which to understand what may be of importance. In accordance with the NT EPA stakeholder engagement and consultation guidelines, consultation will be guided by the principles of engagement, based on stakeholder level of interest and concern as outlined by the. The IAP2 core values for practicing public participation and community engagement are:

1. Public participation is based on the belief that those who are affected by a decision have a right to be involved in the decision-making process;
2. Public participation includes the promise that the public's contribution will influence the decision;
3. Public participation promotes sustainable decisions by recognising and communicating the needs and interests of all participants, including decision makers;
4. Public participation seeks out and facilitates the involvement of those potentially affected by or interested in a decision;
5. Public participation seeks input from participants in designing how they participate;
6. Public participation provides participants with the information they need to participate in a meaningful way; and
7. Public participation communicates to participants how their input affected the decision (IAP2 2014).

The purpose of these core values is to help make better decisions which reflect the interests and concerns of potentially affected people and entities (IAP2 2014).

3.3 Stakeholder Groups

Table 1-2 identifies the initial list of initial stakeholder groups considered as part of the SEP. It is to be acknowledged that this is an initial list and as the SEP is implemented, further stakeholders and more specific stakeholder details will be added. A full list of potential stakeholders is in **Attachment 1.**

3.4 Level of Engagement

The Project consultation associated with the referral and subsequent phases of the Project will be in accordance with the IAP2 principles to determine the appropriate levels of engagement (IAP2 2015). As the Project progresses, the level of engagement will be identified and determined on a case-by-case basis and certain stakeholders may be involved and collaborate on aspects of the Project. Stakeholder engagement is an essential component in the process of assessing the Project's social, economic and environmental impact.

For the purpose of managing the level of engagement with stakeholder, stakeholders have been grouped as follows:

- Level 1: Landholders, Indigenous Stakeholders or Traditional Owners, surrounding tenure holders and Government;
- Level 2: Key interest groups and local communities;
- Level 3: General public, community and special interest groups, wider region and Territory - based organisations.
- Approaches or requirements that must be implemented due to statutory obligations and regulatory requirements.

Table 3-1 provides the IAP2 spectrum's level of engagement and Santos' relevant approach at each level. For Level 3 stakeholders the level of participation for this Project is anticipated to be inform and consult, for Level 2 stakeholders inform, consult and involve, and for Level 1 stakeholders, collaboration is anticipated.

The stakeholders' ability to influence decisions depends on the decision type and what aspects of the Project are negotiable and what aspects are non-negotiable (IAP2 2015). The process is intended to be flexible and open to including relevant stakeholders to the maximum extent possible, while maintaining focus on targeted engagement where it makes sense.

Table 3-1 IAP2 Levels of Engagement

Level of Engagement	Stakeholder Level	Approach to the Community and Stakeholders
Inform	1, 2 and 3	Santos will aim to keep stakeholders informed
Consult	1, 2 and 3	Santos will keep stakeholders informed, listen to and acknowledge concerns and aspirations, and provide feedback on how stakeholder input influenced the decision.
Involve	1 and 2	Santos will work with stakeholders to ensure that their concerns and aspirations are directly reflected in the assessment completed and control measures employed and provide feedback on how stakeholder input influenced decision.
Collaborate	1	Santos will look to stakeholders for advice and innovation in formulating solutions and incorporate their advice and recommendations into the decisions to the maximum extent possible.
Empower	1	Santos will implement relevant stakeholder decisions where appropriate and feasible.

Amended from IAP2 2015

3.5 Identification of Potential Concerns and Opportunities

Potential concerns and opportunities that may be experienced by stakeholders during the lifecycle of the project have been outlined in Table 3-2 below. The purpose of this identification is to understand stakeholder perspectives on what may be of concern to them regarding the project so that Santos can understand potential impacts to stakeholders and what may trigger potential risks.

Understanding stakeholder concerns and their view regarding potential impacts (both actual and perceived) means that Santos can tailor why and how it engages with stakeholders and control the key messages that are communicated. This is also critical to understanding potential stakeholder risks, which in many cases are driven by perceptions stakeholders have of things that are important to them and may often be emotive and subjective. Often these perceptions may not be 'actual impacts' or supported by technical studies but it is critical to understand these.

Table 3-2 is an initial identification of potential concerns and opportunities and as such must be re-visited once Santos has undertaken more detailed engagement with stakeholders during the life of the Project. It is important that as part of this, environmental concerns and opportunities are identified as these are often key areas of interest for stakeholders. Although this SEP is focused on the pre-construction lifecycle phase, potential concerns and opportunities have been identified across the project lifecycle as these perceptions and potential impacts will influence how stakeholders need to be engaged from the beginning of the project.

Table 3-2 Potential concerns and opportunities that may be experienced by stakeholders during the project life-cycle

Project Phase	Potential concerns (perceived or actual)	Potential opportunities (perceived or actual)
Pre-construction (includes approvals)	+ Potential contamination of water or land from access for surveys + Potential introduction of invasive species from access for surveys + Potential direct mortality of fauna from vessel access + Potential to disturb unidentified Indigenous and non-Indigenous cultural heritage items through initial surveys and investigations + Potential for minor rubbish from initial investigative surveys and site investigations	+ Surveys build understanding of activities likely to be impacting greater regional environment + Build understanding of the fauna condition and habitat values + Protection of fauna habitat due to any offsetting + Increased training and employment opportunities improving capabilities and skills in local and regional areas + Increase in the local and regional socio-economic conditions + Opportunities for local suppliers and contractors + Employment and business opportunities for Indigenous community members
Construction (construction of the Project)	+ Potential water quality impacts, resulting from disturbance, accidental pollutant and contaminant releases + Exposure of soil to erosive factors during earthworks + Potential contamination of water or land through contaminant release (e.g. diesel leakage) + Site clearance and resulting environmental impact + Disturbance to habitat connectivity + Excessive noise during construction potentially leading to species fragmentation + Artificial light spill on the environment potentially disturbing and altering behaviour of a range of species	+ Data from monitoring health of water resources during construction + Greater understanding of ecological environment due to any ongoing Project investigations + Management and protection of fauna habitat + Increased training and employment opportunities improving capabilities and skills in local and regional areas + Increase in the local and regional socio-economic conditions + Opportunities for local suppliers and contractors

Project Phase	Potential concerns (perceived or actual)	Potential opportunities (perceived or actual)
	+ Visual amenity impacts + Potential for inappropriate behaviour of contractors and employees + Potential disturbance of unidentified Indigenous and non-Indigenous cultural heritage items (despite cultural heritage clearance)	+ Employment and business opportunities for Indigenous community members + Protection of any identified items of cultural heritage significance
Operations (operations of the Project)	+ Potential water quality impacts, resulting from watercourse disturbance, accidental pollutant and contaminant releases + Potential contamination through contaminant release (e.g. diesel leakage) + Disturbance to habitat connectivity + Potential spread and introduction of weeds during operation + Potential fire as a result of operations leading to destruction of habitat + Site clearance and resulting environmental impact + Potential for inappropriate behaviour of contractors and employees + Potential disturbance of unidentified Indigenous and non-Indigenous cultural heritage items (despite cultural heritage clearance) + Potential increase in local waste volumes during operation + Potential water and land contamination	+ Management and protection of remaining flora on site + Greater understanding of ecological environment due to any ongoing Project investigations + Management and protection of fauna habitat remaining on site + Potential to provide visual amenity management measures + Increased training and employment opportunities improving capabilities and skills in local and regional areas + Increase in the local and regional socio-economic conditions + Opportunities for local suppliers and contractors + Employment and business opportunities for Indigenous community members + Protection of any identified items of cultural heritage significance
Decommissioning	+ Loss of jobs and employment	+ Rehabilitation of the Project site and habitat + Potential re-use of Project components

3.6 Level of Engagement and Activities

Based on the analysis above, the following levels of engagement have been identified for stakeholder groups. These levels are based on the principle that engagement will be tailored by considering levels of stakeholder impact, interest and influence, and risk – with the assumption that the higher the level of impact and risk – the deeper the level of engagement required. This approach needs be flexible based on each specific stakeholder group and potential changes in stakeholder expectations and risk. Description of engagement levels and example activities are provided in Table 3-3.

Table 3-3 Different depths of engagement / communication

Level of engagement	Description	Example Activities
General	+ Generalised provision of project information and updates (this includes overview of potential impacts and mitigation / management strategies) + Opportunities to provide feedback through general activities and communication mechanisms (e.g. via website, email, as part of statutory consultation approach) + Audience: all stakeholders have access to information and activities	+ Website + Project information sessions + Media releases + Public consultation process
Targeted	+ Targeted engagement and communications specific to stakeholder group + Targeted engagement and communication activities designed to gain specific feedback + Ongoing opportunities to provide feedback and discuss key project elements (e.g. how potential impacts to a specific value could be managed) + Audience: while information may or not be publicly available activities are targeted towards specific group of stakeholders and are generally not open to 'general public'	+ Targeted group briefings or presentations + Targeted group or individual meetings + Targeted information portal e.g. ICN + Access to all general activities
Individualised	+ Engagement and communications developed for needs and expectations of specific stakeholder + Focus on gaining specific feedback and input from individuals / small group of individuals + Information in the form it was provided only accessible to specific party with which it was shared e.g. while a Minister may be provided	+ One-on-one meetings focused on specific topic of interest for both parties + Negotiation of formal contract or partnership (e.g. supplier agreement) + Shared value definition workshop / partnership

Level of engagement	Description	Example Activities
	information about jobs etc. that is available to the public the content of the conversation will be confidential	regarding social investment + Personalised email / phone conversations
Regulatory	+ Ongoing interaction with the regulator. This will be tailored depending on agency roles + More structured and individualised engagement will occur with lead agency + Ongoing opportunities to provide feedback	+ Structured meetings and communication schedule with lead agency + One-on-one / group meetings as required + Ongoing email and phone communication as required

3.7 Monitoring and Evaluation

Santos will maintain a stakeholder management register to record external stakeholder interactions for the Project (pre-construction, construction, operation). It is important that this register is updated by all team members following engagement activities so these can be adequately monitored and any stakeholder concerns or opportunities followed up. This is particularly important for the approvals process as records of engagement activities need to be summarised and provided as part of approvals documents to demonstrate adequate engagement has been undertaken.

From a risk management perspective, this is also important for Santos as/if issues arise there is a formal record of engagement that has been undertaken, and how these issues have been closed out as appropriate. If Santos undertakes broader sustainability reporting at a corporate level, these types of records can also be drawn on to align with Corporate.

With regards to monitoring the effectiveness of this plan, the implementation shall be reviewed quarterly. The plan should be revised, including the stakeholder analysis, prior to the commencement of each Project stage to incorporate lessons learned, stakeholder feedback and evolving issues, opportunities and risks that may have arisen.

Any review should consider the following:

+ Feedback from the regulator, external stakeholders, Santos employees and contractors;
+ Any complaints or findings from audit, review and inspections;
+ The outcomes of any incidents and how they can be managed / mitigated in the future;
+ Changes in Santos organisation structures, roles and responsibilities; and
+ Changes in regulation and guidelines that may impact engagement expectations of the regulator and community.

4 Community and Stakeholder Consultation Program

The following consultation program establishes the activities to be undertaken and key project milestones. All consultation activities undertaken for the Project are provided in the register located in **Attachment 2**.

Table 4-1 Consultation Phases

Stage	Description	Activities	Progress
Pre-Referral Stage	+ Initial regulatory engagement to outline the project and confirm necessary inclusions in the assessment; and + Early engagement with government, councils and port users regarding proposal.	+ Communication via email, phone etc. + One-on-one meetings	Complete
Post-Referral Stage	+ Activities to improve general stakeholder awareness of the project and avenues for providing input; + Targeted engagement and communications specific to stakeholder groups; + Targeted engagement and communication activities designed to gain specific feedback from the Referral.	+ Communication via email, phone etc. + One-on-one meetings + Technical meetings and briefings + Website (General) + Media releases (General)	Pending
Notification of Approval and Conditions	+ Update the Stakeholder Engagement Plan as necessary; + Undertake activities to inform stakeholders of the approval and conditions; and + Provide information to stakeholders on the next steps and project schedule.	+ Communication via email, phone etc. + One-on-one meetings + Website (General)	Pending
Construction Stage	+ Update the Stakeholder Engagement Plan as necessary; and + Early notification to key potentially affected stakeholders (e.g. local community) of project construction commencement and actions being implemented to manage risks; and + Undertake stakeholder and community engagement as required to satisfy approval conditions and achieve compliance with statutory obligations for construction.	+ Communication via email, phone etc. + One-on-one meetings + Website (General)	Pending

Stage	Description	Activities	Progress
	+ Provide general awareness of the avenues for stakeholder complaints.		
Operational Stage	+ Update the Stakeholder Engagement Plan as necessary; and + Undertake stakeholder and community engagement as required to satisfy approval conditions and achieve compliance with statutory obligations for the operation; + Undertake activities to maintain community and stakeholder awareness regarding avenues for project information and complaints.	+ Communication via email, phone etc. + One-on-one meetings + Website (General)	Pending
Decommissioning	+ Update the Stakeholder Engagement Plan as necessary; and + Notification of closure of the facility to relevant stakeholders; + Inform local and regional community of ongoing site management following closure.	+ Communication via email, phone etc. + One-on-one meetings + Website (General)	Pending

5 References

International Association for Public Participation (IAP2) 2015 Quality Assurance Standard for Community and Stakeholder Engagement, viewed 21 October 2021, Available: International Association for Public Participation Australasia, https://www.iap2.org.au/Tenant/C0000004/00000001/files/IAP2_Quality_Assurance_Standard_2015.pdf

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International Finance Corporation 2007, Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, May 2007, Washington, USA.

Northern Territory Environment Protection Authority (NT EPA 2021a), Preparing an Environmental Impact Statement (EIS) – Environmental impact assessment guidance for proponents, viewed 21 October 2021, Available: https://ntepa.nt.gov.au/__data/assets/pdf_file/0009/818217/preparing-an-environmental-impact-statements.pdf.

NT EPA 2021b, Stakeholder Engagement and Consultation – Environmental impact assessment guidance for proponents, viewed 21 October 2021, Available: https://ntepa.nt.gov.au/__data/assets/pdf_file/0005/884696/guidance-proponents-stakeholder-engagement-and-consultation.pdf.

Attachment 1 Stakeholder List

Stakeholder
Community groups
Amateur Fishermen's Association of NT (AFANT)
Australian Marine Conservation Society, NT
Australian Marine Science Association, NT
Charles Darwin University
Community members who reside or work in the greater Darwin area or surrounding region
Darwin Harbour Advisory Committee
Environment Centre, NT
Sea Turtle Foundation
Indigenous groups
Aboriginal Areas Protection Authority
NAILSMA
Northern Land Council
Tiwi Land Council (NT)
Wickham Deed Reference Group
Commonwealth Government
Australian Fisheries Management Authority
Australian Hydrographic Office
Australian Maritime Safety Authority
Australian Communications and Media Authority
Department of Agriculture, Water & Environment
Department of Defence
Department of Industry, Science & Resources
Director of National Parks
HMAS Coonawarra Naval Base
NOPTA
NOPSEMA
Northern Territory Government

Department of Chief Minister and Cabinet
Department of Environment, Parks & Water Security
Department of Infrastructure, Planning & Logistics
Department of Industry, Tourism & Trade (Fisheries)
Department of Industry, Tourism & Trade (Energy)
Environment Protection Authority (personnel)
Environment Protection Authority (Board)
Member for Arafura
NT Environment Protection Authority
Northern Territory Police, Fire and Emergency Services
NT Worksafe
Industry – Commercial Fishing
A. Raptis & Sons Pty Ltd (WA)
Aquarium Fishery License Holders (NT)
Austfish Pty Ltd (WA)
Austral Fisheries Pty Ltd (WA)
Australia Bay Seafoods (WA)
Coastal Line Fishery Licence-holders
Demersal Fishery License Holders (NT and WA)
Monsoon Aquatics (NT)
Northern Prawn Fishing Industry Pty Ltd (NPF)
Northern Prawn Fishery Licence-holders
Northern Territory Seafood Council (NTSC)
Northern Wildcatch Seafood Australia (WA)
Offshore Net and Line Fishery License Holders (NT)
Paspaley Pearling Company (NT)
Pearl Oyster Fishery License Holders (NT and WA)
Pearl Producers Association
Spanish Mackerel Fishery License Holders (NT)
WA Seafoods
Industry - Other

Arafura Bluewater Charters (NT)
Australian Marine Oil Spill Centre
Chamber of Commerce, NT
Darwin Port
Darwin Port Users Group
ENI Australia
ICN Network NT
INPEX
NT Guided Fishing Industry Association
NT Tourism
Oil Spill Response Ltd
Sea Darwin
SK E&S
Sun Cable
Top End Fishing
Territory and Federal Politicians
The Hon. Michael Patrick Francis Gunner MLA, Chief Minister
The Hon. Nicole Susan Manison MLA, Deputy Chief Minister
The Hon. Natasha Kate Fyles MLA, multiple ministerial titles
The Hon. Eva Dina Lawler MLA, multiple ministerial titles
The Hon. Lauran Jane Moss MLA, multiple ministerial titles
The Hon. Selena Jane Malijarri Uibo MLA, multiple ministerial titles
The Hon. Paul Andrew Kirby MLA, multiple ministerial titles
The Hon. Kate Jane Worden MLA, multiple ministerial titles
The Hon. Chanston James Paech MLA, multiple ministerial titles
The Hon. Warren Snowdon MP, Federal Member for Lingiari
The Hon. Sussan Ley MP, Federal Minister for the Environment

Attachment 2 Consultation Register

The following is a list of the main consultation undertaken to date with key stakeholders to inform preparation of the NT-EPA Referral prior to its submittal. A summary of the key themes of issues/concerns discussed to date is included in the NT EPA Referral.

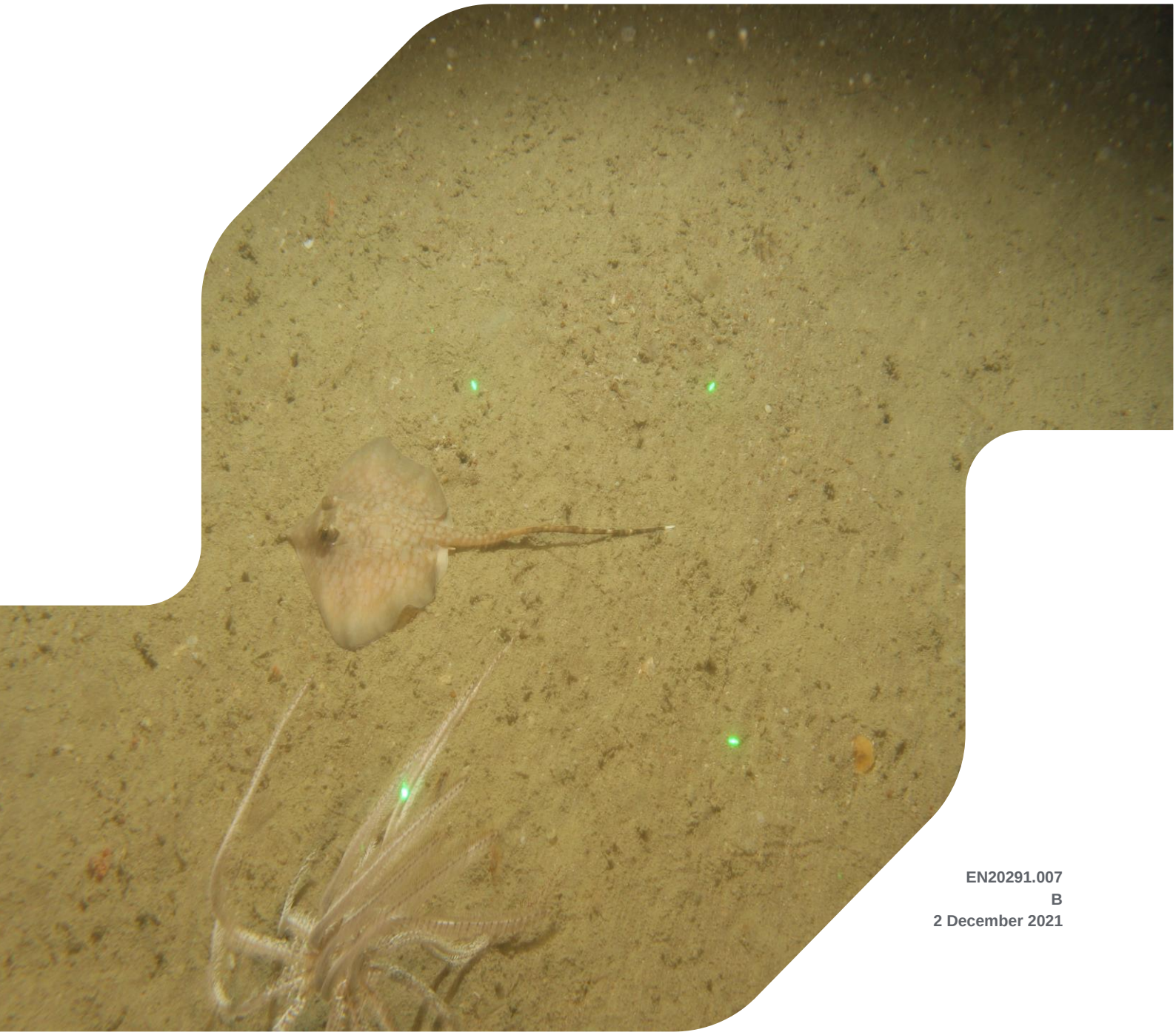
Stakeholder	Date	Description of Engagement
ALL	8 October 2021	Distribution of project update
Tiwi Land Council executive	19 October 2021	Meeting
Darwin LNG	20 October 2021	Meeting
Australia Bay Seafoods	20 October 2021	Meeting
NT Department of Environment, Parks & Water Services	21 October 2021	Meeting
NT DITT - Fisheries	21 October 2021	Meeting
NT Guided Fishing Industry Association	21 October 2021	Meeting
NT DITT - Energy	22 October 2021	Meeting
Darwin Port	22 October 2021	Meeting
Northern Prawn Fishery	25 October 2021	Meeting
NT DITT - Tenure	25 October 2021	Meeting
Sun Cable	25 October 2021	Meeting
Aboriginal Areas Protection Authority	26 October 2021	Meeting
Northern Land Council	26 October 2021	Meeting
NT Amateur Fishers Association	27 October 2021	Meeting
Tiwi Resources	27 October 2021	Meeting
NT Department of Infrastructure, Planning & Logistics (supports Darwin Harbour Advisory Committee)	4 November 2021	Meeting
NOPSEMA/NOPTA	5 November 2021	Meeting

Stakeholder	Date	Description of Engagement
Inpex	8 November 2021	Meeting
NT Heritage Commission	9 November 2021	Meeting
NT DITT-Energy	10 November 2021	Meeting #2
NT-DEPWS	17 November 2021	Meeting #2
HMAS Coonawarra Naval Base	17 November 2021	Meeting
Environment Centre NT (ECNT)	17 November 2021	Meeting
NT-DIPL	18 November 2021	Meeting #2
Wickham Deed Reference Group (Larrakia via DLNG)	19 November 2021	Meeting
Tiwi land owner groups	23, 25 November 2021	Meetings via zoom
Sea Darwin	24 November 2021	Phone
Aboriginal Areas Protection Authority Board meeting	2 December	Presentation
EPA Board	7 December 2021	Presentation
Darwin Harbour Advisory Committee	16 December 2021	Presentation

Appendix D – Environmental Baseline Survey – Interim Field Report

SANTOS BAROSSA DPD

Interim Field Report #2



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2 December 2021

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Rev A	Draft for internal review	NatRob	JerFit		5/11/2021
Rev B1	Interim report for referral	NatRob	GarHoo		2/12/21

Approval for issue

J. Fitzpatrick	[14/12/2021

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Contents

Tables

Plates

Figures

1 INTRODUCTION

Santos is exploring options for the Darwin Pipeline Duplication (DPD) Project associated with development of the Barossa gas field in northern Australia. The pipeline would run from the point where the Barossa gas export pipeline (GEP) intersects the existing Bayu-Undan (BU) pipeline (kilometre point (KP) 0), running alongside the existing BU GEP into Darwin LNG plant at Wickham Point in Darwin Harbour (KP122.2). The pipeline would be trenched using a dredge in areas within the harbour and then laid on the seabed in offshore outside of the harbour. Dredge spoil will be placed at an offshore dredge spoil disposal site adjacent the existing INPEX spoil ground outside the harbour in Northern Territory waters. Seabed material sourced from sand waves at the mouth of Darwin Harbour will be used to backfill the trench once the pipeline has been laid. These activities have potential to cause environmental impacts which must be identified, quantified, mitigated, and managed to acceptable levels.

In support of environmental approvals for the DPD project, Santos has developed a team of consultants to deliver environmental approvals, baseline studies, management plans and discharge modelling. RPS was engaged to conduct the baseline environmental survey for the project, designed to fill gaps in the existing dataset. Sampling sites were selected partly to ensure representation of the different sections of the pipeline route and partly to investigate features identified from preliminary interpretation of geophysical data recently collected along the pipeline route by Fugro.

The baseline survey included the following areas:

- The pipeline route from KP0 (equivalent to Bayu-Undan pipeline kilometre point (KP) 380) to ~KP91 (Darwin Harbour port boundary)
- The proposed spoil ground
- The pipeline route within Darwin Harbour (KP91 to KP122).

1.1 Objectives

The Barossa DPD offshore survey objectives were to:

- Undertake water quality, sediment quality and benthic habitat and communities assessments along the proposed pipeline route and at the spoil ground.
- Identify any areas of higher environmental value or sensitivity to inform the Environmental Impact Assessment (EIA) for the project.

1.2 Purpose

The purpose of this field survey report is to provide a summary of the field activities and results from the field surveys, including a brief description of the key features and benthic habitats along the pipeline route and at the spoil ground area. This document will be updated as further data, including laboratory analytical results, become available.

2 METHODS

2.1 Survey team and vessel

The survey was carried out on the Lauri J supplied and crewed by Bhagwan Marine. Fugro provided the survey Party Chief, navigation and deck operations support. RPS designed and conducted the sampling and collected the sediment and water samples and benthic imagery.

2.2 Sampling sites

The survey design was supplemented in the field with additional sites based on any potential features identified during the Fugro geophysical scope. The survey was divided into three sampling locations and the samples coded accordingly; the offshore pipeline (OP; KP0 and ~KP91), Darwin Harbour pipeline (HS; ~KP91 and KP122, including the sand wave dredge areas), and the spoil ground (SG; Figure 2-1). The sampling sites were based on historical geophysical data, and therefore considered representative of the full pipeline corridor, including the anchoring areas either side of the proposed pipeline route.

Table 2-1: Sample naming conventions for the Barossa DPD survey

Sample location	Sample type	Sample ID	Number of sites
Offshore pipeline	Sediment	OP	33
	Drop Video	OP	9
	Video Transect	V	17
	Surface water	OP S	10
	Bottom water	OP B	10
Spoil Ground	Sediment	SG	13
	Drop Video	SG	13
	Surface water	SG S	7
	Bottom water	SG B	7
Darwin Harbour	Sediment	HS	53
	Video Transect	HS	30

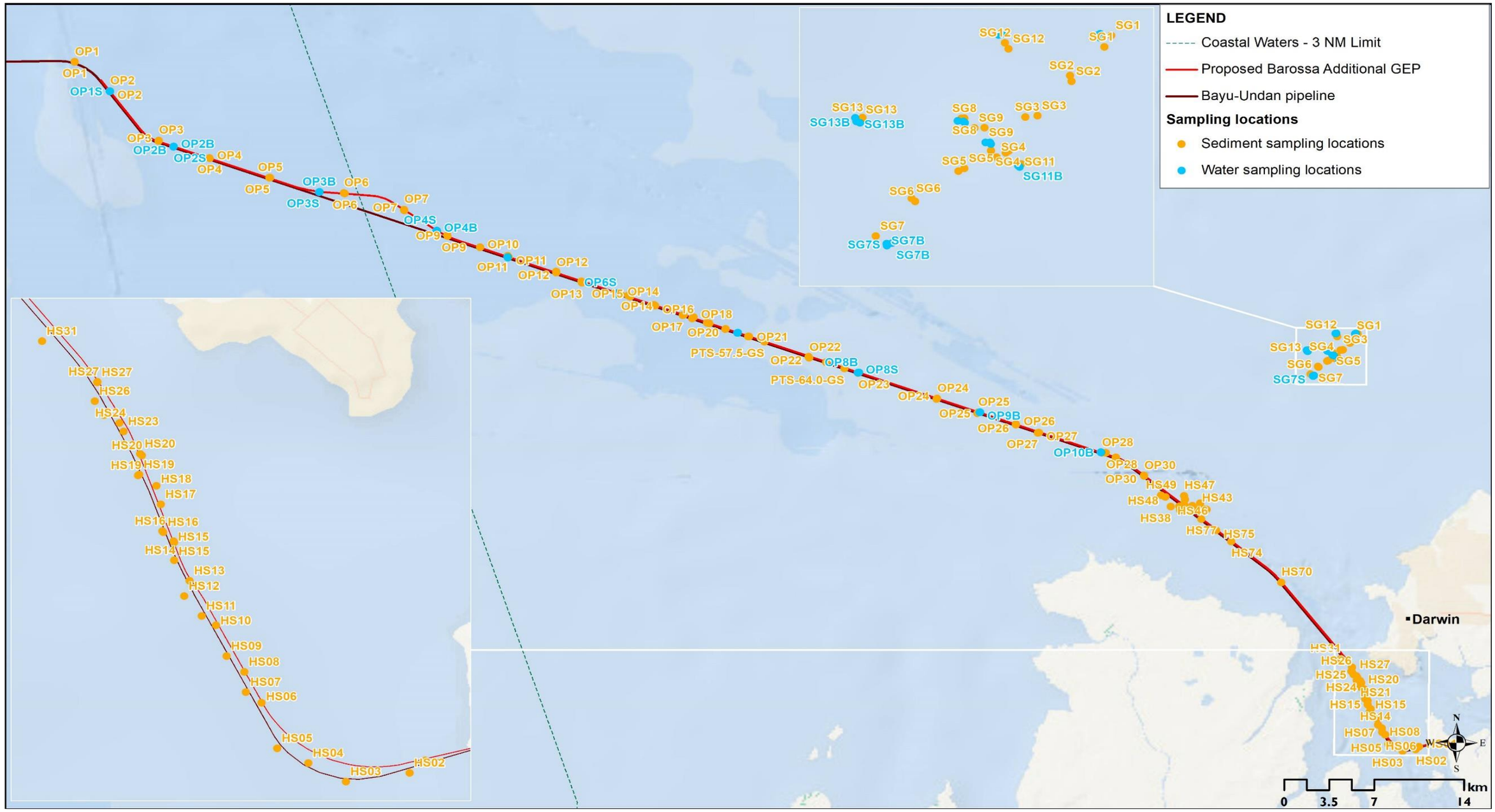


Figure 2-1: Sediment and water quality sites along the proposed Barossa pipeline route and Spoil Ground

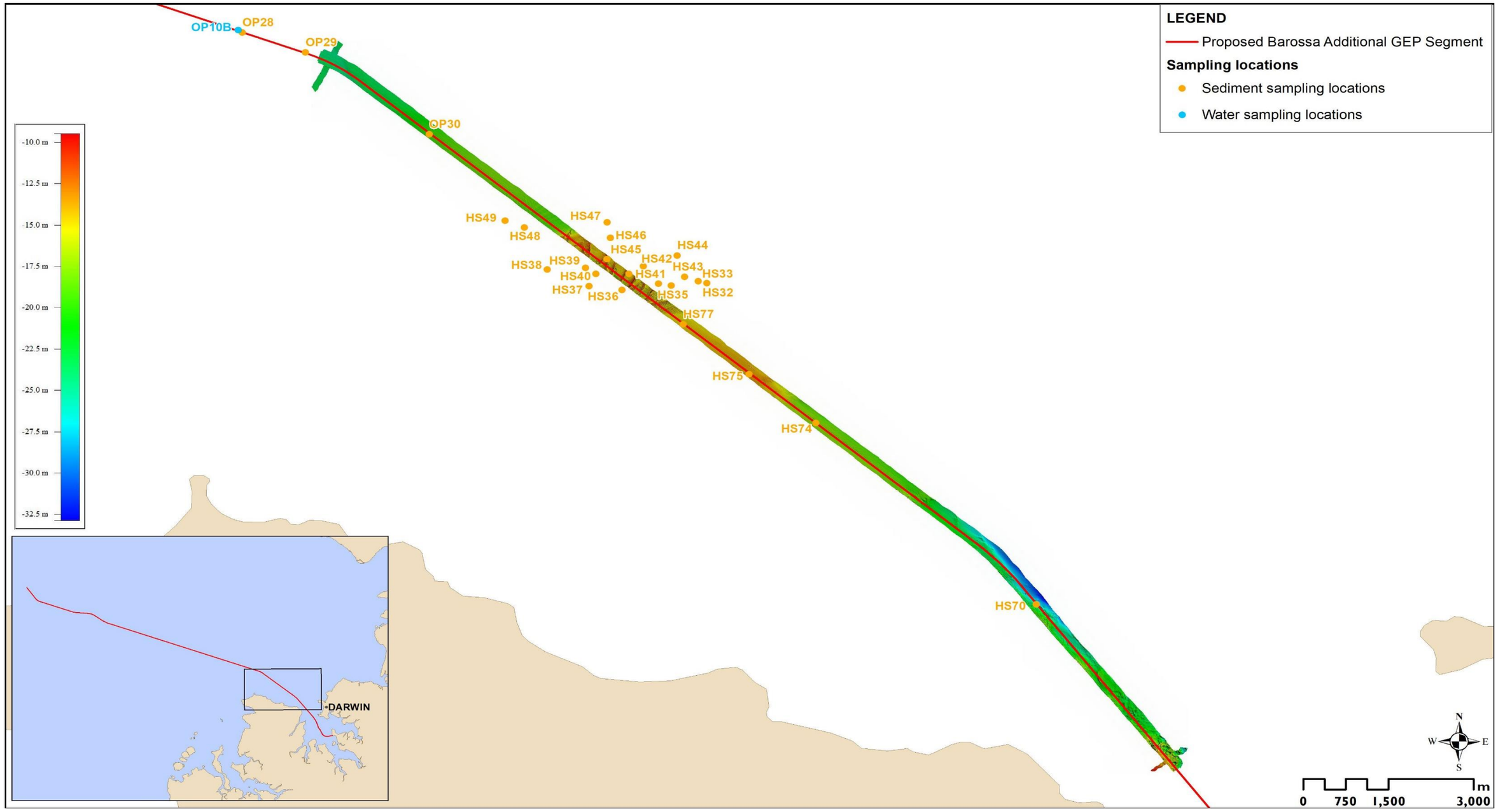


Figure 2-2: Darwin Harbour sediment sites and sand wave area, showing 2021 north multi-beam data

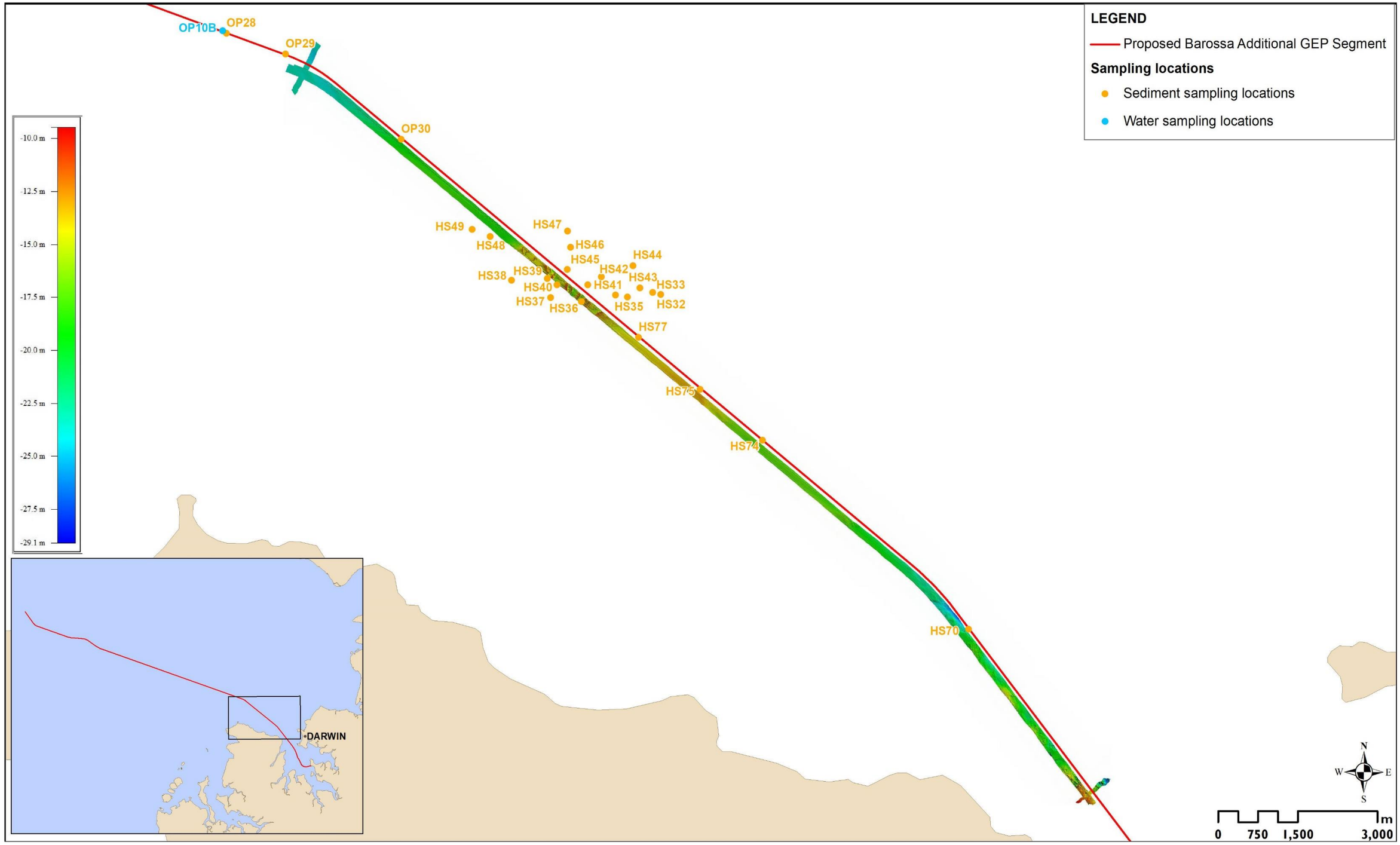


Figure 2-3: Darwin Harbour sediment sites and sand wave dredge area, showing 2021 south multi-beam data

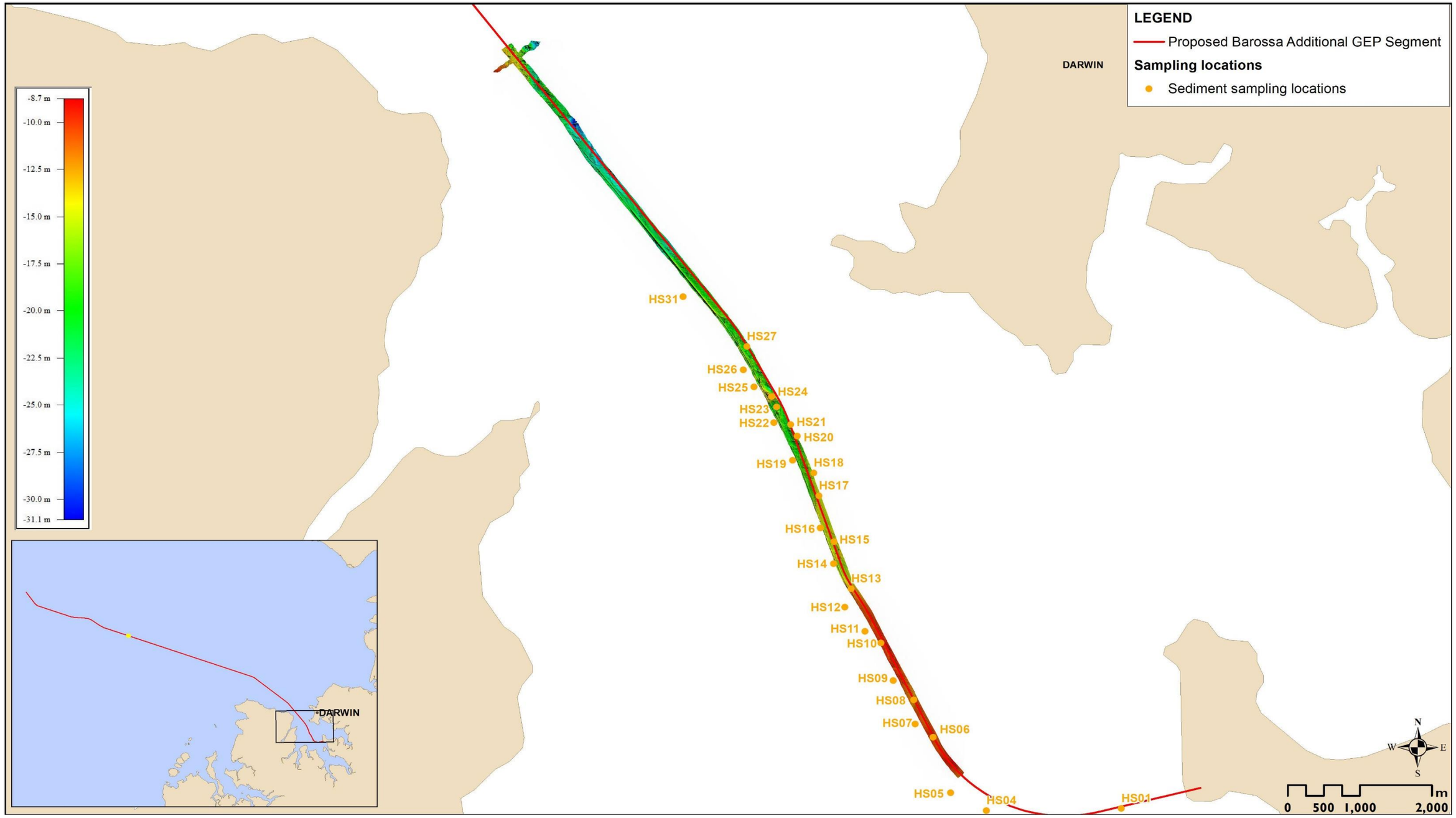


Figure 2-4: Darwin Harbour sediment sites, showing 2021 north multi-beam data

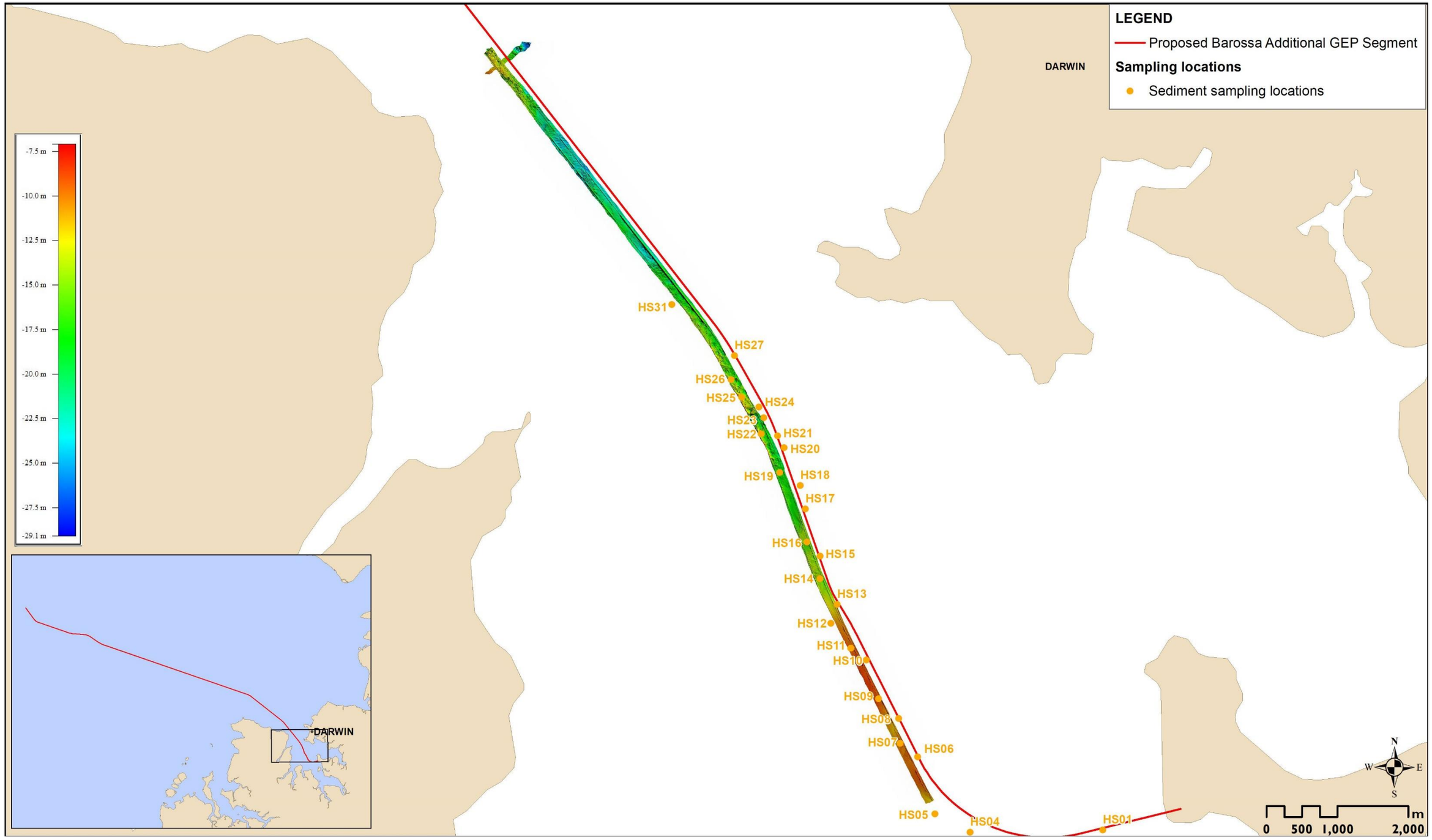


Figure 2-5: Darwin Harbour sediment sites, showing 2021 south multi-beam data

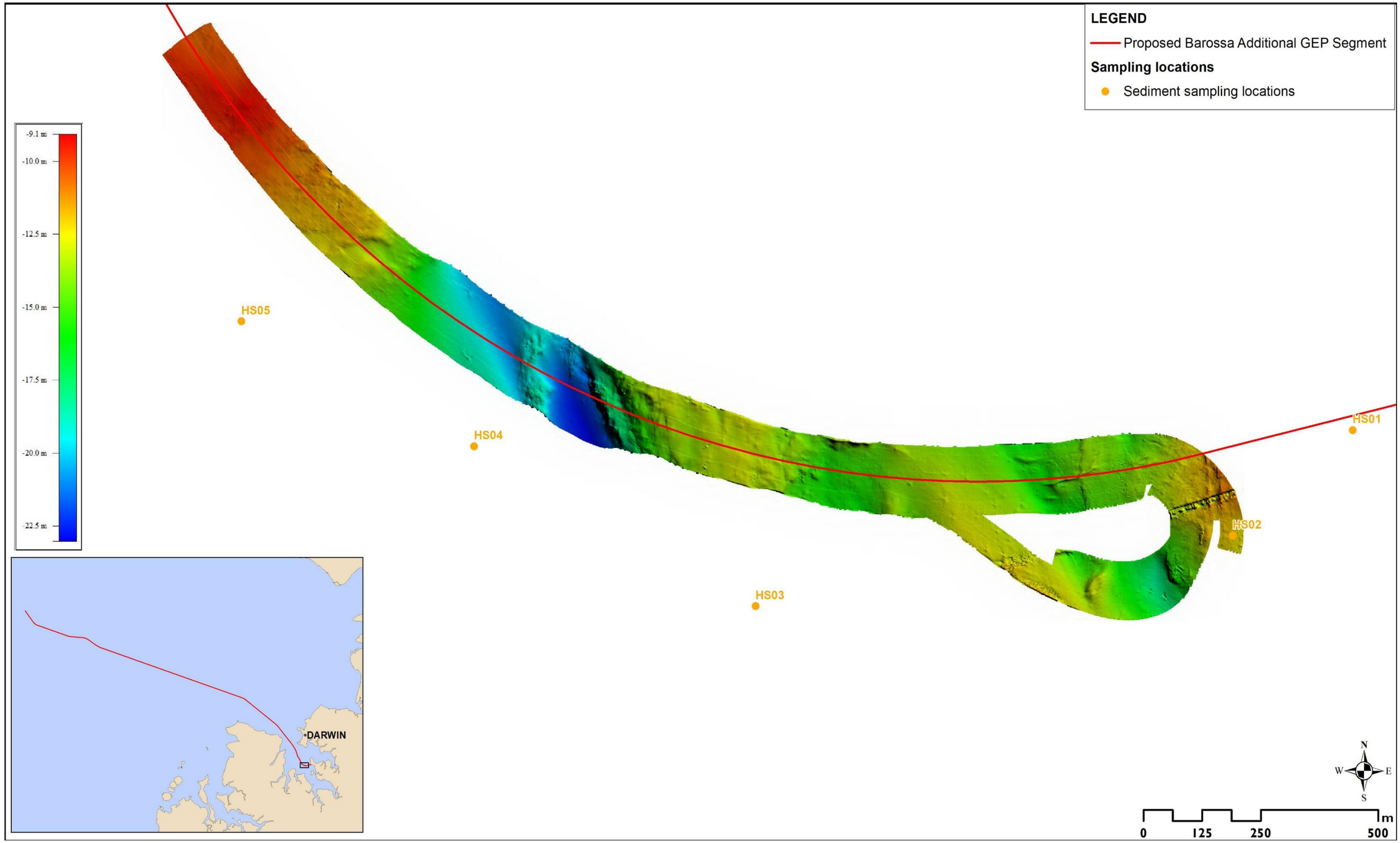


Figure 2-6: Darwin Harbour sediment sites close to the shore crossing, showing 2021 north multi-beam data

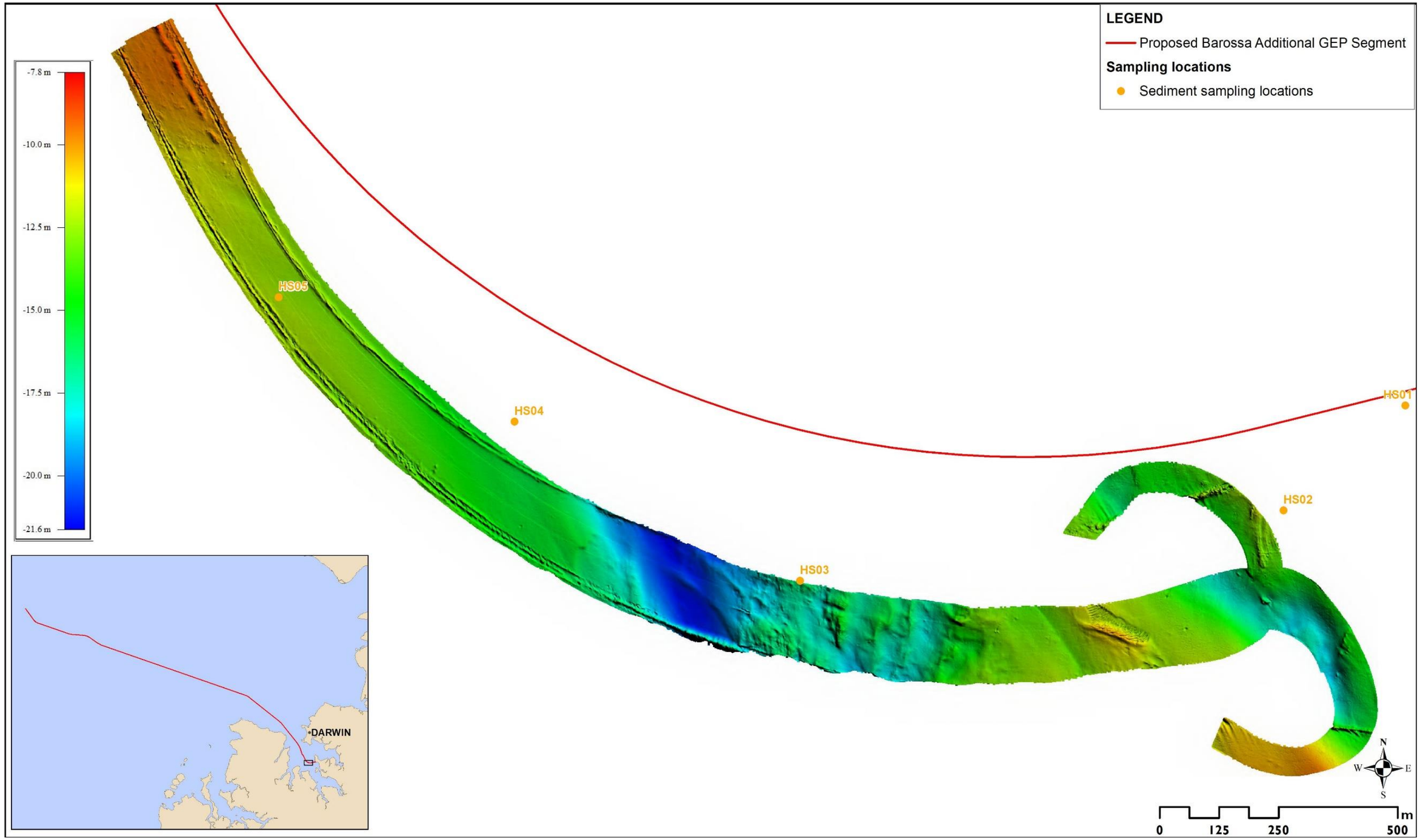


Figure 2-7: Darwin Harbour sediment sites close to the shore crossing, showing 2021 south multi-beam data

2.3 Subsea Video

An SeaSpyder subsea video system mounted on a drop camera frame was used to collect digital video and stills imagery (Plate 2-1). The colour video camera was fitted with a zoom lens controllable from the surface control unit and live imagery was transmitted to the control room on the vessel via a load-bearing umbilical. Imagery was also recorded for subsequent analysis. The system also comprised a stills camera, lighting system and lasers (spaced 20 cm apart).

The benthic habitats observed and recorded during each camera drop were described by RPS marine scientists. ESRI's ArcPad software was used to record the positional data for the tracklog of the towed video transect and the spot-point positions for each still image taken. During the video deployments, vessel speed did not exceed a speed of ~1.5 knots. The imagery collected will be analysed in detail by marine scientists at RPS to characterise topographic features, benthic habitats and macrofaunal communities.

The video system was deployed at a total of sixty-nine (69) sites across the pipeline route and spoil ground. Video site locations were initially based on positions of seabed features derived from the original Bayu-Undan geophysical survey data. Locations of interest were then identified in the field, using the 2021 Fugro geophysical survey data, and the video site locations and transects were adjusted accordingly.

Plate 2-1: The SeaSpyder camera system

2.4 Sediment Quality

2.4.1 Sample collection

Sediments were sampled at 30 offshore pipeline locations, with an additional three sampled for particle size distribution only at the request of Santos), 13 spoil ground locations and 53 Darwin Harbour pipeline locations (including the sand wave area). Samples were collected using a double van Veen grab mounted in a single frame (with a sampled surface area of each grab being 0.1 m^2), which was deployed and retrieved by Fugro personnel. An optimal sample processing area was identified as part of strict contamination risk management protocols. GPS position, depth, time and date were recorded every time the grab reached the

seabed. Upon retrieval to deck, each sample was photographed with a video slate showing the project, site, sample number and date. Each sample was then characterised to document conspicuous biota, sediment types, presence of visible anoxic layers, hydrocarbons or anthropogenic material. If samples could not be obtained at the site (after 3 attempts), then the site was moved and sampled nearby (within 50 m).

2.4.1.1 Subsampling – sediment contaminants

Subsamples for contaminant samples were taken from the top 2 - 5 cm of grab samples - excluding surficial sediments within 5-10 mm of the sides of the grab (to reduce the risk of contamination). Sediment was removed using a stainless-steel scoop and placed in a glass bowl for mixing. All implements had been pre-cleaned with Decon-90.

Once homogenised, sediment was placed in the appropriate laboratory-supplied sample containers. The PSD sample was also taken from surficial sediments to allow direct comparison between contaminants and sediment grain sizes.

For all samples:

- Sterile gloves were worn at all times when collecting and processing samples. These were changed between samples
- The insides of sample lids did not come into contact with anything potentially contaminated
- Jars and bags were sealed, correct labelling confirmed, and then stored in an esky with ice blocks
- At the end of each shift, samples were stored as identified in Table 2-2.

2.4.1.2 Sampling- infauna

A full 0.1 m^2 van Veen grab sample was collected for infaunal assessment at each site. The infauna sample was carefully emptied into a fish tray and then placed into the infauna processing table (Plate 2-2). The sample was carefully washed using sea water from the deck hose, with the washings flowing out through the sluice gate and draining through a 1mm mesh sieve. The rate of flow through the sluice was managed by controlling the volume of water within the table, and the amount of water flowing through the sluice gate. The sieve was rotated or shuffled to prevent clogging. When the sieve was almost full, the sluice gate was shut to stop the flow, and the full sieve swapped out for an empty sieve. A puddling bin was used to remove as much remaining sediment as possible through the sieve. Samples were then carefully washed out into a plastic Ziplock bag and preserved with 100% ethanol (to a final concentration of ~80% in seawater).

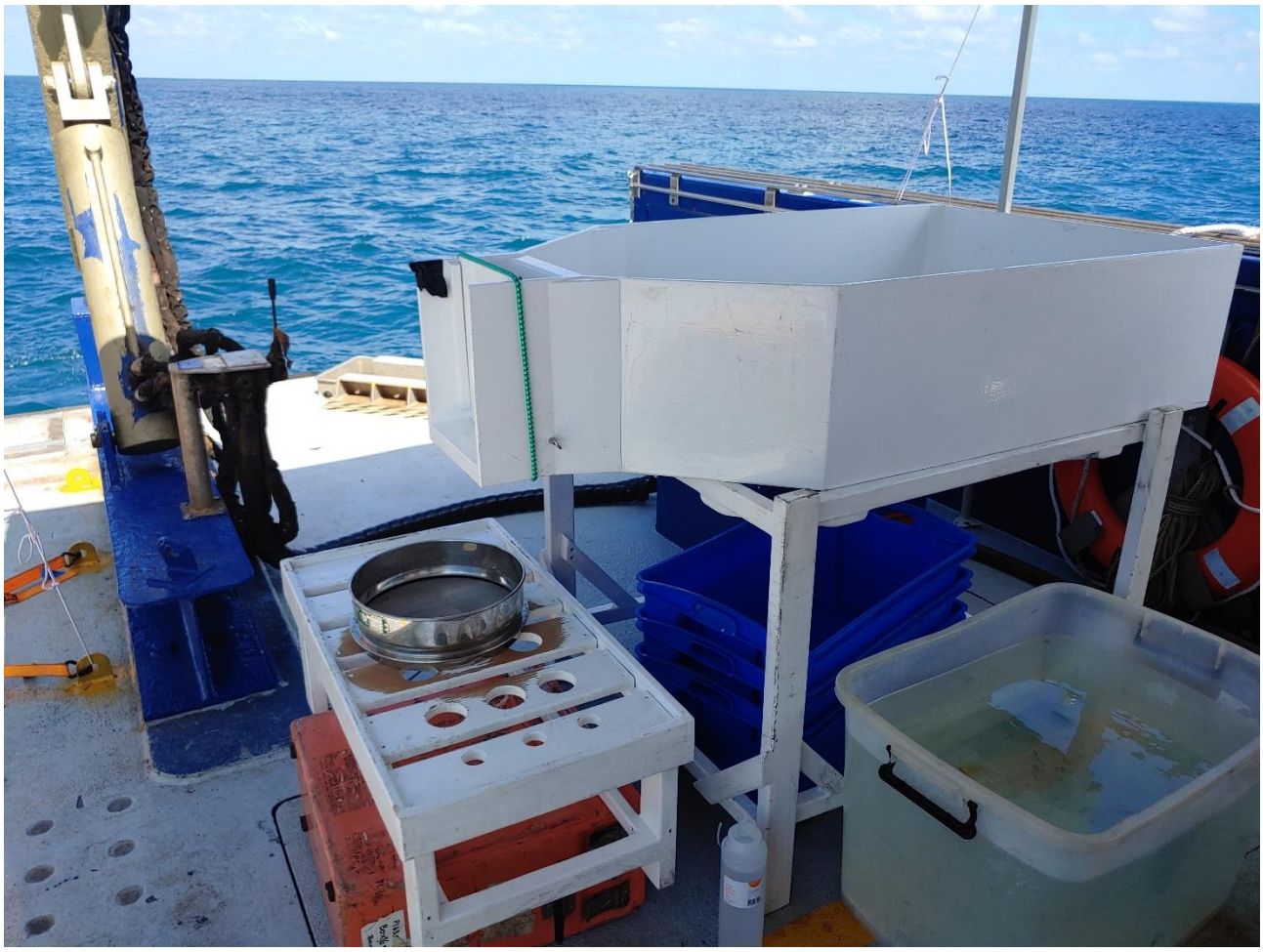


Plate 2-2: Infauna filtering table set up on the Lauri-J

2.4.2 Offshore DPD and spoil ground

Sediment samples for contaminants, particle size distribution and infauna were collected from 33 pipeline sites (including the additional three PSD sites were added during the survey) and 13 spoil ground sites, (Table 2-2).

Table 2-2: Sediment quality sampling summary for Barossa offshore DPD and spoil ground sites

Sample	# of samples (Spoil Ground)	# of samples (DPD)	Total Samples	Laboratory	Lab LOR*	Container	Volume	Storage method	Holding time
Particle Size Distribution (PSD)	13	33	46	MAFRL	NA	Ziplock bag	250 ml	Freeze	5 years
Infauna	13	30	43	Benthic Australia	NA	Bucket	0.1 m^2	Ethanol	
Total Organic Carbon (TOC)	13	30	43	MAFRL	<0.1%	2 x plastic jars	70 ml	Freeze	1 month
Metals and metalloids (Al, Sb, As, Ca, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Ag, Zn)	13	30	43	MAFRL	Depends on metal-0.01-2				
Nutrients (Total Phosphorous (TP))	13	30	43	MAFRL	<0.05				
Nutrients (Total Kjeldahl Nitrogen (TKN))	13	30	43	MAFRL	<0.1				
Total Recoverable Hydrocarbons (TRH) & Benzene, Toluene, Ethylbenene, Xylenes and Naphthalene (BTEXN)	13	30	43	ALS	0.2 - 5 mg/kg, 1 %	Glass Jar	150 ml	Cold	14 days
Polycyclic Aromatic Hydrocarbons (PAH; where TRHs are above limits of detection)	0	0	0	ALS	4 - 5 µg/kg			Cold	14 days
Naturally-Occuring Radioactive Materials (NORMS; Radium^{226}, Radium^{228}, Thorium^{228})	13	30	43	SGS	3, 5, 3 Bq/kg	Zip-lock	250 ml	Freeze	1 month

*LoR = limit of reporting.

2.4.3 Darwin Harbour DPD

Sediment samples for contaminants and PSD were collected from 53 sites along the pipeline route in Darwin Harbour (Table 2-3).

Table 2-3: Sediment quality sampling summary for Darwin DPD sites

Sample	Total Samples	Laboratory	Lab LOR	Container	Volume	Storage method	Holding time
Particle Size Distribution (PSD)	53	MAFRL	NA	Ziplock bag	250 ml	Freeze	5 years
TBT	53	ALS	NA	Glass Jar	250 ml	Cold	14 Days
TOC	53	ALS	0.02 %	Glass Jar	250 ml	Cold	14 days
Metals and metalloids (Al, Sb, As, Ca, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Ag, Zn)			Depends on metal- 0.01-50				
Nutrients (TP)			2 mg/kg				
Nutrients (TKN)			20 mg/kg				
TRH & BTEXN			0.2 - 5 mg/kg, 1 %				
PAH (where TRH is above limits of reporting)	37		4 - 5 µg/kg				
Acid Sulphate Soils (ASS)	53	ALS	0.1 pH Unit, 1 -	Zip-lock	250 ml	Freeze	14 days
Organochlorine pesticides and Polychlorinated biphenyls	53	ALS	0.25 - 0.5 µg/kg 5 µg/kg	Glass Jar	250 ml	Cold	14 days
NORMS (Ra^{226}, Ra^{228}, Th^{228})	53	SGS	3, 5, 3 Bq/kg	Zip-lock	250 ml	Freeze	1 month

2.5 Water Quality

2.5.1.1 Water column profiling

Water column profiling was undertaken using a calibrated SeaBird SBE19plusV2 conductivity, temperature depth (CTD) profiler lowered through the water column at a rate of half a metre per second at each of the 17 water quality sampling locations. The maximum deployment depth (the position of the profiler above the seabed) was determined from the vessel echosounder prior to deployment. The following parameters were recorded in each profile:

- Pressure (to derive depth)
- Conductivity (to derive salinity)
- Temperature
- pH
- Dissolved oxygen
- Turbidity

The data was downloaded off the seabird after each profile.

2.5.1.2 Sample collection

Water samples were collected at the sea surface (1 to 5 m below sea level (BSL)) and near the seabed (5 m above seabed (ASB)) using 10 litre Niskin bottles.

Phytoplankton and total suspended solids (TSS) samples were collected by filtering a 3 L sample of water through a filter tower (Plate 2-3). Phytoplankton samples were collected through a 0.8-1.2 µm filter, whilst TSS samples were filtered through a pre-weighed filter (stored in an envelope until used). Each filter paper was folded into quarters and wrapped in a dry piece of filter paper and placed back in the envelope for storage. Filtered metal samples were drawn through filter using a syringe. These samples were then transferred to a small pre-labelled sample jar. All other samples were placed in pre-labelled containers.

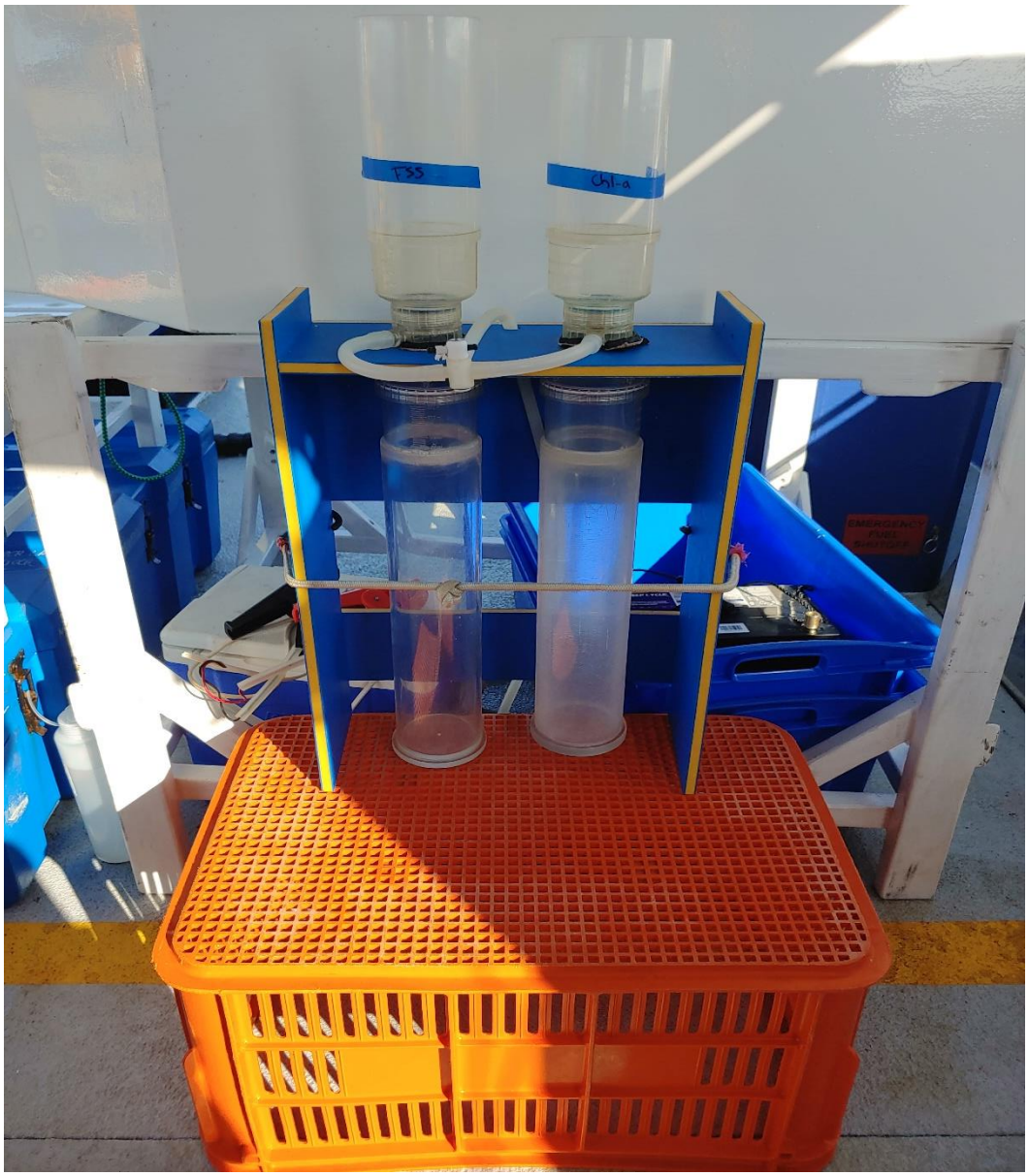


Plate 2-3: Water quality filtering station set up on the Lauri-J

Table 2-4: Water quality sampling requirements

Analyte	Sample # (Spoil Ground)	Sample # (Offshore)	Total Samples	Laboratory	Lab LOR	Container	Volume	Storage method	Holding time
TSS	14	20	34	MAFRL	1 mg/L	Filter paper placed in zip lock bag	NA	Cold	7 days
Nutrients (TP/ Total Nitrogen (TN))	14	20	34	MAFRL	5 µg.P/L/ 50µg.N/L	PP container	125 ml	Freeze	1 month
Orthophosphate	14	20	34	MAFRL	2 µg.P/L	PP tubes	10ml		
Nitrite and nitrate (NO_2 and NO_3)	14	20	34		2 µg.N/L				
Ammonium (NH_4+)	14	20	34		3 µg.N/L				
Phytoplankton pigments (Chlorophyll-a and Phaeophytin-a)	14	20	34	MAFRL	0.1 mg/L	Filter paper placed in zip lock bag	NA	Freeze (in dark)	1 month
Unfiltered Metals and metalloids (As, Ca, Cr, Co, Cu, Pb, Ni, Zn)	14	20	34	MAFRL	0.05-1µg/L	PP tube	10 ml	Cold	2 weeks
Unfiltered Hg	14	20	34	MAFRL	0.1µg/L	Dark bottles	125 ml	Cold	2 weeks
Filtered Metals and metalloids (As, Ca, Cr, Co, Cu, Hg, Pb, Ni, Zn)	14	20	34	MAFRL	0.05-1µg/L	PP container	125 ml	Cold	2 weeks
Filtered Hg	14	20	34	MAFRL	0.1µg/L	Dark bottles	125 ml	Cold	2 weeks
TRH & BTEXN	14	20	34	ALS	1 - 100 µg/L	Purple glass vials (Sulfuric Acid)	2 x 40 ml	Cold	1 week
PAH (where TRH above LORs)	0	0	0	ALS	0.5 - 1 µg/L	Orange glass bottle	100 ml	Cold	1 week
NORMS (Ra^{226}, Ra^{228}, Th^{228})	7	10	17	SGS	0.05,0.1,0.03 Bq/L	Plastic container	1000 ml	Nitric acid	6 months

2.6 Quality Assurance and Quality Control

Prior to sampling, the deck area was assessed for potential sources of contamination. Where there had been clear washout of the surficial sediments in grab samples (e.g. due to a shell or rock caught in the jaws of the grab) the sample was discarded and classed as a failed attempt. Similarly, if water from the winch wire was observed dripping into the sample, the sample was discarded as it was potentially contaminated by hydrocarbons from the winch.

RPS requires that laboratories use NATA-accredited methods and have a Quality Assurance and Quality Control (QA/QC) program, where possible. Pre-cleaned sample containers for chemical analyses were provided by the laboratories for this survey. The following control process were undertaken to quantify potential within-laboratory variability in analysis and any potential sample contamination that could have occurred during sample collection, handling, storage or transport. All samples were transported with relevant and fully completed Chain of Custody (CoC) documentation.

2.6.1 Triplicates/Duplicates

Triplicate sediment and water samples were collected at the offshore pipeline and spoil ground sites, while duplicates were collected within the Darwin Harbour sites, to determine potential within-laboratory variability in analyses. At least one triplicate or duplicate sample was collected for every twenty primary samples. Triplicates and duplicates were collected from the same bulk sediment sample as the primary sample and were labelled appropriately. The labelling code for triplicates allowed RPS to identify the collection site but it was not apparent to the laboratories.

2.6.2 Trip blanks

Trip blanks, or transport blanks, are used to assess potential contamination of samples during transport and storage. Trip blanks were supplied by the laboratory and consisted of plastic jars pre-filled with deionised water. They remained unopened during sampling. Rinsate water was used rather than inert sediment as it is considered to be a more sensitive test.

2.6.3 Field blanks

Field blanks detect contamination from sample handling, dust and other atmospheric fallout during the sampling process. Laboratory-supplied deionised water was decanted and stored in the same containers and in the same way as for the sediment samples and left open during sediment sampling. Water was used rather than inert sediment as it is considered to be a more sensitive test.

2.6.4 Equipment blanks

Equipment blanks measure contamination introduced through contact with sampling equipment. These may be taken depending on the condition of the equipment and potential for contamination. The samples were taken after the grab sampler had been decontaminated with Decon-90. After decontamination, the operator thoroughly rinsed the grab with seawater, then rinsed it again with the laboratory-supplied deionised water, which was captured in a laboratory-supplied sample container. This will detect potential contamination from the stainless-steel grab sampler.

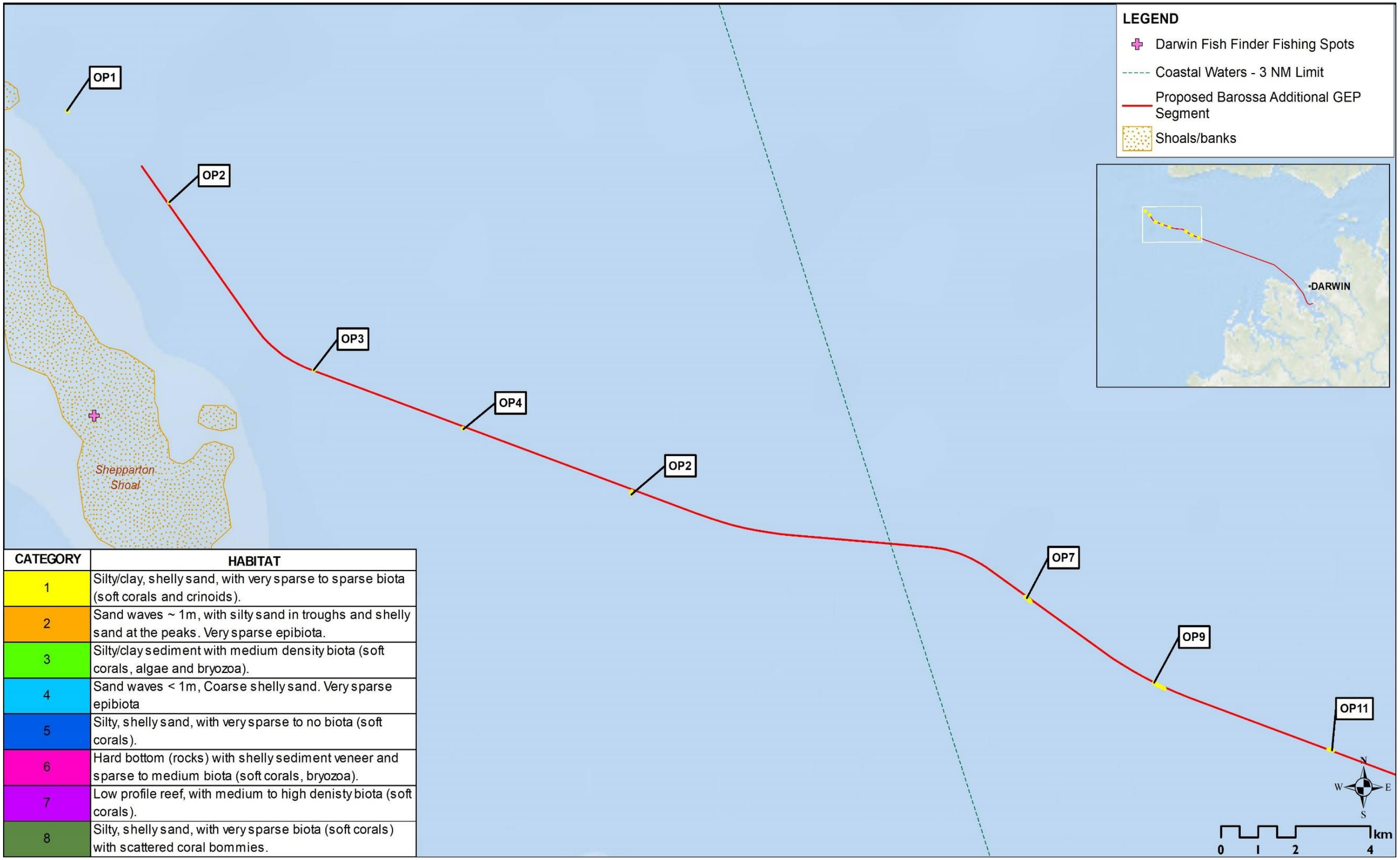
2.6.5 Sample preservation and storage

Water containers were filled to ~80% to leave a head-space sufficient to allow for expansion of the sample during freezing. During vessel demobilisation, samples were separated based on the laboratory they were being shipped to and transferred to clean eskies containing ice blocks for delivery to the laboratory. Chain of custody forms were filled out for each laboratory and sent with the relevant eskies.

3 RESULTS

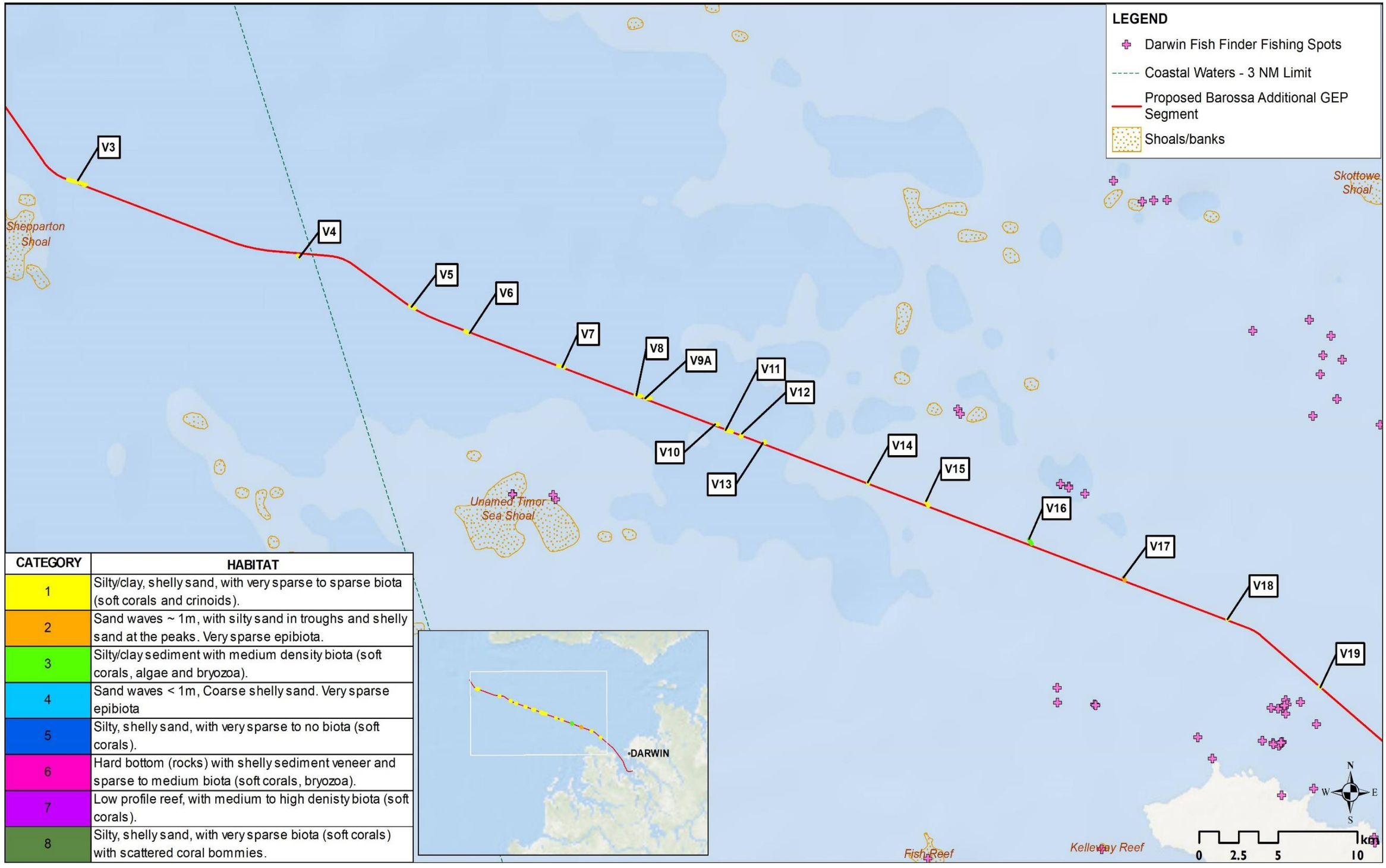
3.1 Benthic Habitat

Eight high-level habitat types were identified along the Barossa DPD pipeline route and in the spoil ground area. This comprised six soft substrate habitats and two hard substrate habitats. The hard substrate habitats were limited to the Darwin Harbour section of the pipeline route. Darwin Fish Finder TM GPS Database was used to overlay fishing sites onto the habitat maps. Offshore fishing sites were commonly identified with known shoals, rather than the pipeline (Figure 3-1 and Figure 3-2). Inside Darwin Harbour, higher densities of fishing sites were located in close proximity to areas identified as hard substrate (Figure 3-4 and Figure 3-5).



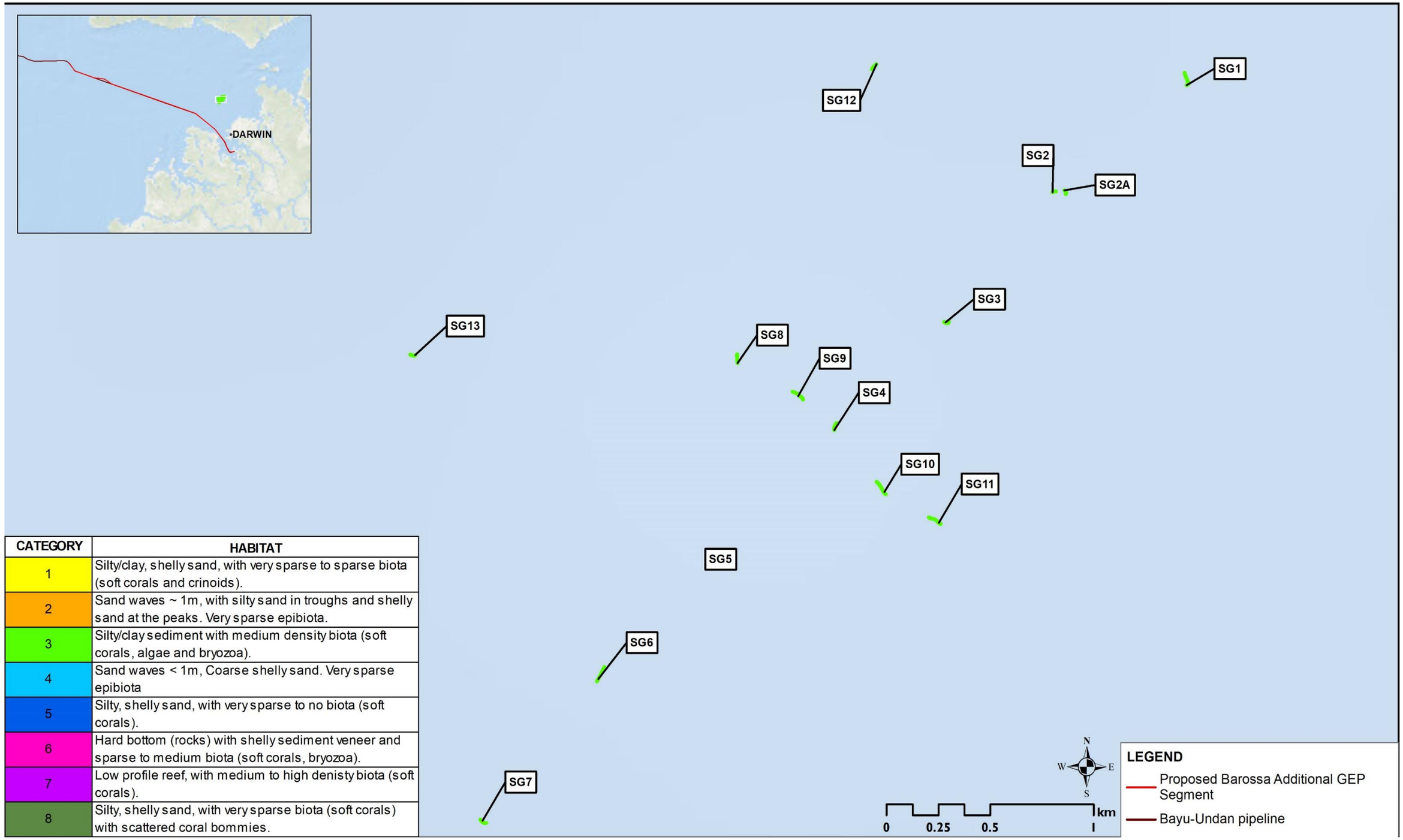
CATEGORY	HABITAT
1	Silty/clay, shelly sand, with very sparse to sparse biota (soft corals and crinoids).
2	Sand waves ~ 1m, with silty sand in troughs and shelly sand at the peaks. Very sparse epibiota.
3	Silty/clay sediment with medium density biota (soft corals, algae and bryozoa).
4	Sand waves < 1m, Coarse shelly sand. Very sparse epibiota
5	Silty, shelly sand, with very sparse to no biota (soft corals).
6	Hard bottom (rocks) with shelly sediment veneer and sparse to medium biota (soft corals, bryozoa).
7	Low profile reef, with medium to high denisty biota (soft corals).
8	Silty, shelly sand, with very sparse biota (soft corals) with scattered coral bommies.

Figure 3-1: Habitat types identified along the offshore pipeline route and Darwin fish finder fishing spots



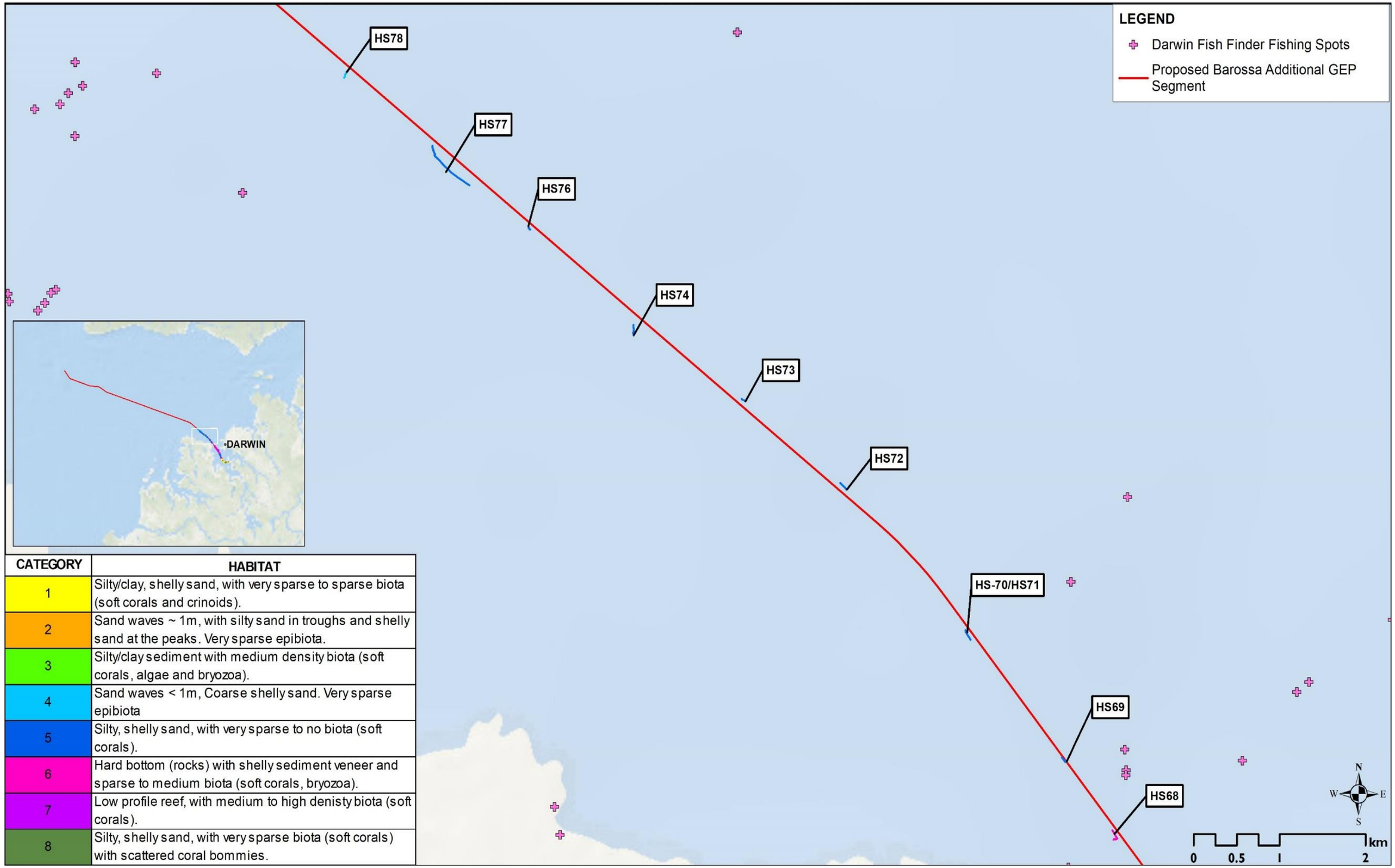
CATEGORY	HABITAT
1	Silty/clay, shelly sand, with very sparse to sparse biota (soft corals and crinoids).
2	Sand waves ~ 1m, with silty sand in troughs and shelly sand at the peaks. Very sparse epibiota.
3	Silty/clay sediment with medium density biota (soft corals, algae and bryozoa).
4	Sand waves < 1m, Coarse shelly sand. Very sparse epibiota
5	Silty, shelly sand, with very sparse to no biota (soft corals).
6	Hard bottom (rocks) with shelly sediment veneer and sparse to medium biota (soft corals, bryozoa).
7	Low profile reef, with medium to high denisty biota (soft corals).
8	Silty, shelly sand, with very sparse biota (soft corals) with scattered coral bommies.

Figure 3-2: Habitat types identified along the offshore pipeline route and Darwin fish finder fishing spots



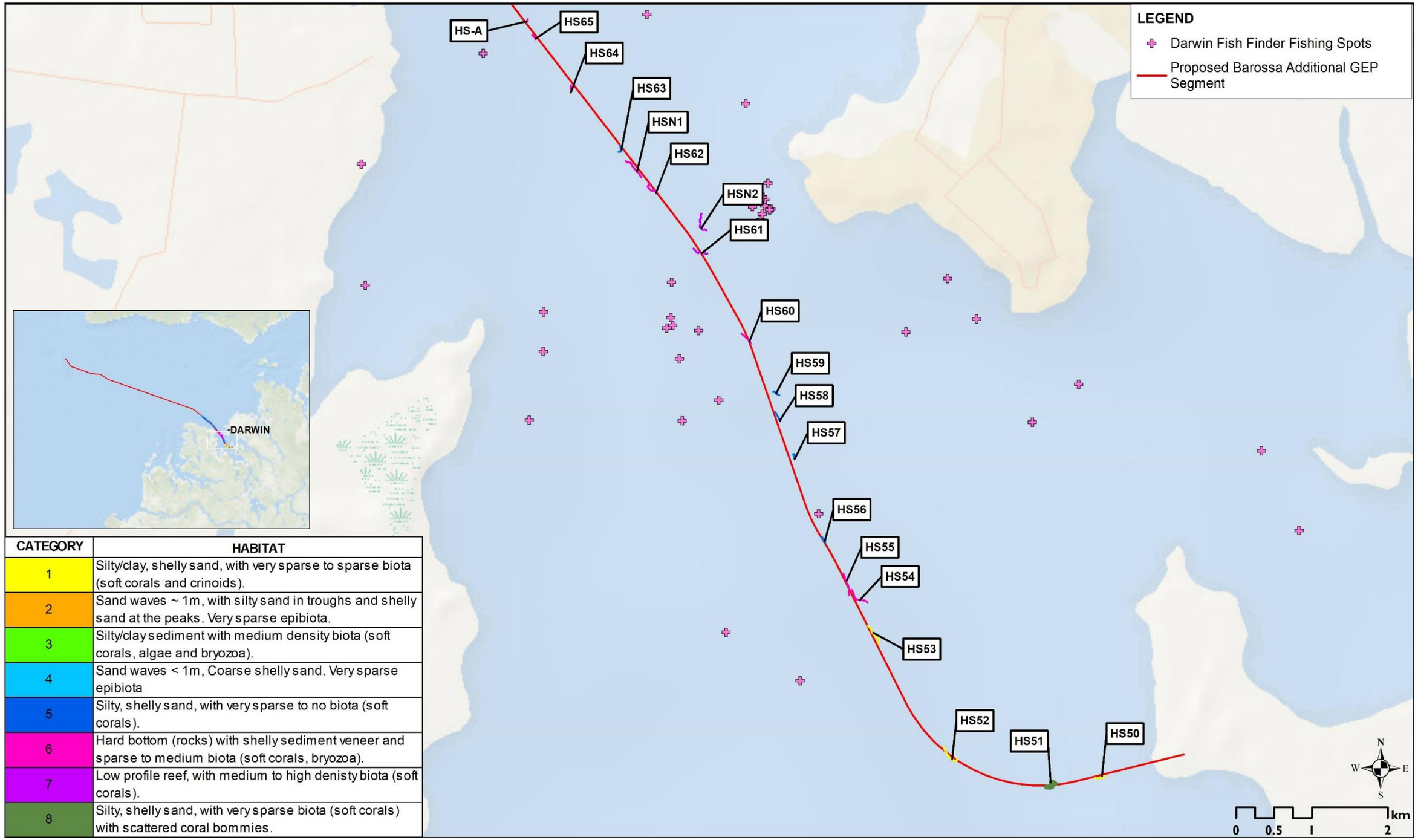
CATEGORY	HABITAT
1	Silty/clay, shelly sand, with very sparse to sparse biota (soft corals and crinoids).
2	Sand waves ~ 1m, with silty sand in troughs and shelly sand at the peaks. Very sparse epibiota.
3	Silty/clay sediment with medium density biota (soft corals, algae and bryozoa).
4	Sand waves < 1m, Coarse shelly sand. Very sparse epibiota
5	Silty, shelly sand, with very sparse to no biota (soft corals).
6	Hard bottom (rocks) with shelly sediment veneer and sparse to medium biota (soft corals, bryozoa).
7	Low profile reef, with medium to high denisty biota (soft corals).
8	Silty, shelly sand, with very sparse biota (soft corals) with scattered coral bommies.

Figure 3-3: Habitat types identified within the Spoil Ground and Darwin fish finder fishing spots



CATEGORY	HABITAT
1	Silty/clay, shelly sand, with very sparse to sparse biota (soft corals and crinoids).
2	Sand waves ~ 1m, with silty sand in troughs and shelly sand at the peaks. Very sparse epibiota.
3	Silty/clay sediment with medium density biota (soft corals, algae and bryozoa).
4	Sand waves < 1m, Coarse shelly sand. Very sparse epibiota
5	Silty, shelly sand, with very sparse to no biota (soft corals).
6	Hard bottom (rocks) with shelly sediment veneer and sparse to medium biota (soft corals, bryozoa).
7	Low profile reef, with medium to high denisty biota (soft corals).
8	Silty, shelly sand, with very sparse biota (soft corals) with scattered coral bommies.

Figure 3-4: Habitat types identified along the northern end of the Darwin Harbour pipeline route and Darwin fish finder fishing spots



CATEGORY	HABITAT
1	Silty/clay, shelly sand, with very sparse to sparse biota (soft corals and crinoids).
2	Sand waves ~ 1m, with silty sand in troughs and shelly sand at the peaks. Very sparse epibiota.
3	Silty/clay sediment with medium density biota (soft corals, algae and bryozoa).
4	Sand waves < 1m, Coarse shelly sand. Very sparse epibiota
5	Silty, shelly sand, with very sparse to no biota (soft corals).
6	Hard bottom (rocks) with shelly sediment veneer and sparse to medium biota (soft corals, bryozoa).
7	Low profile reef, with medium to high denisty biota (soft corals).
8	Silty, shelly sand, with very sparse biota (soft corals) with scattered coral bommies.

Figure 3-5: The habitat along the southern end of the Darwin Harbour pipeline route and Darwin fish finder fishing spots

3.1.1 Soft substrate habitats

3.1.1.1 Offshore pipeline

From KP0 to KP65, seabed habitat was characterised as silty/clay shelly sand (Plate 3-1), with very sparse to sparse conspicuous epibiota (mainly soft corals and crinoids). This soft sediment habitat was identified again at the shoreward end of the pipeline route (near the shore crossing). Biota commonly associated with this habitat type included:

- soft corals, including gorgonians, sea whips (*Junceella* spp.), Neptheidae and Alcyoniidae (Plate 3-2)
- echinoderms including sea urchins, sea stars, sea cucumbers and crinoids (Plate 3-3)
- molluscs, including squid
- crustaceans including shrimp and the painted pebble crab (*Leucosia anatum*).
- burrows and polychaete tubes.

Plate 3-1: Grab sample from site OP1, showing silty shelly sand with clumps of clay.

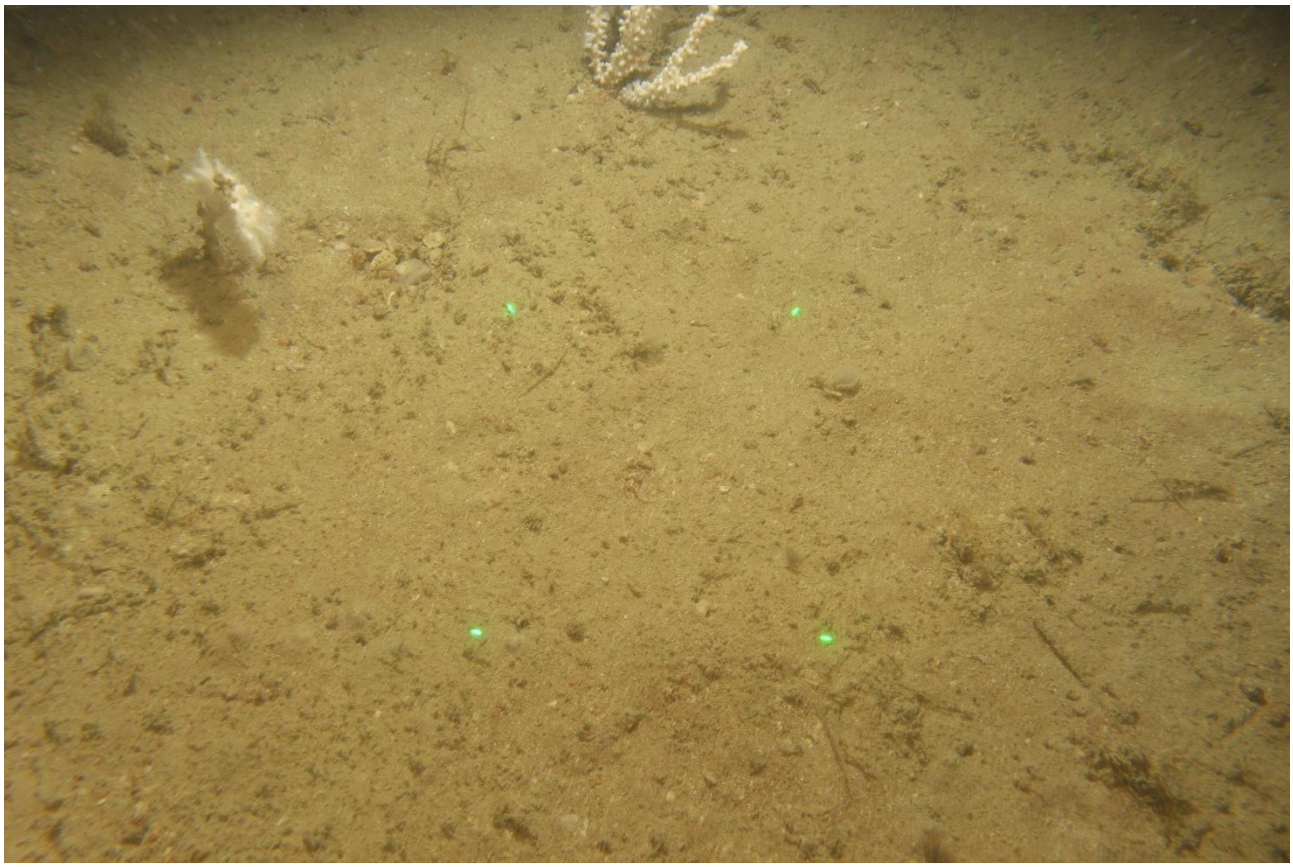


Plate 3-2: Silty, shelly sand with very sparse soft corals (Alcyoniidae) at site OP1

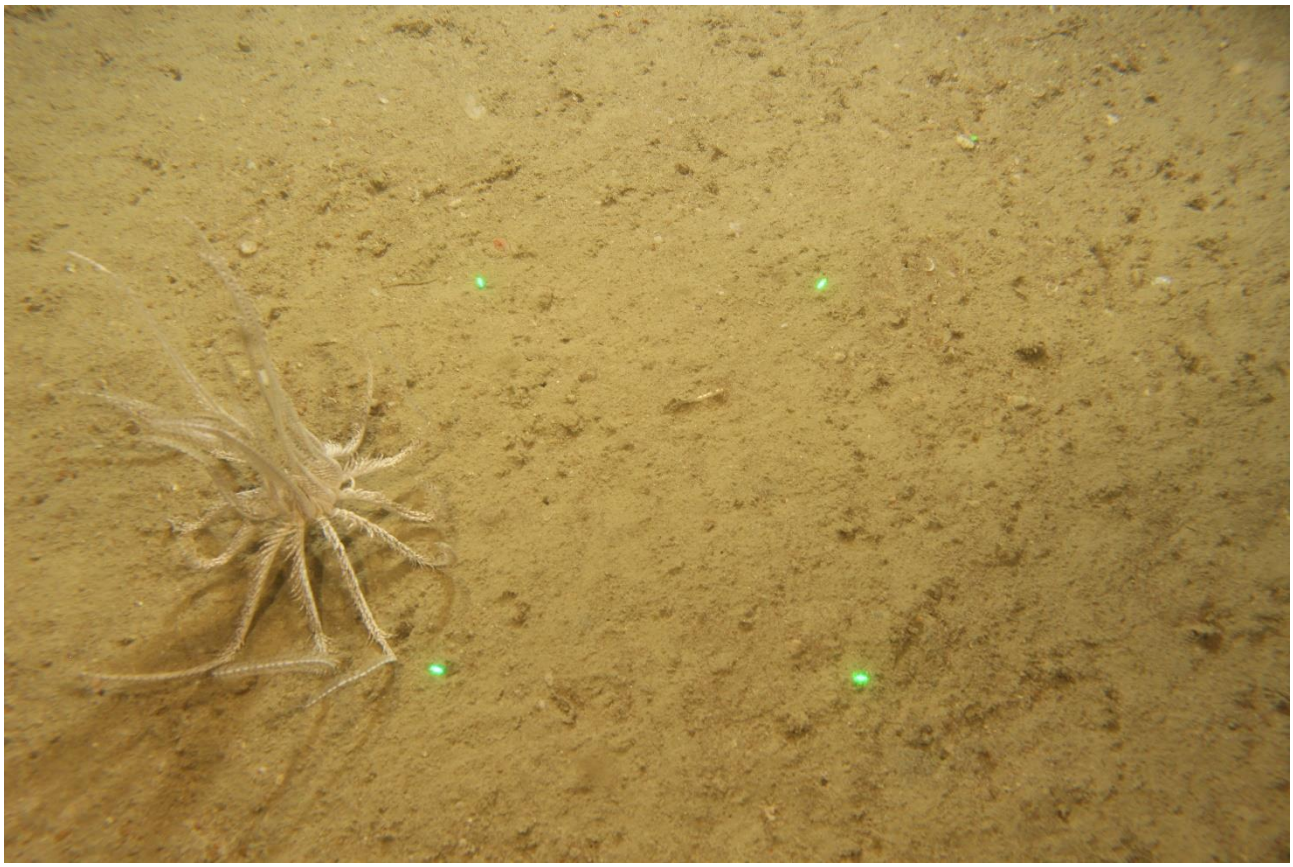


Plate 3-3: Silty/clay sand with a motile crinoid at site V12

Sand waves were recorded at three of these silty/clay shelly sand sites (V10, V11 and V12), roughly 1 m in height, with silty sand in the troughs and coarse shelly sand at the crests. This substrate was associated with very sparse epibiota.

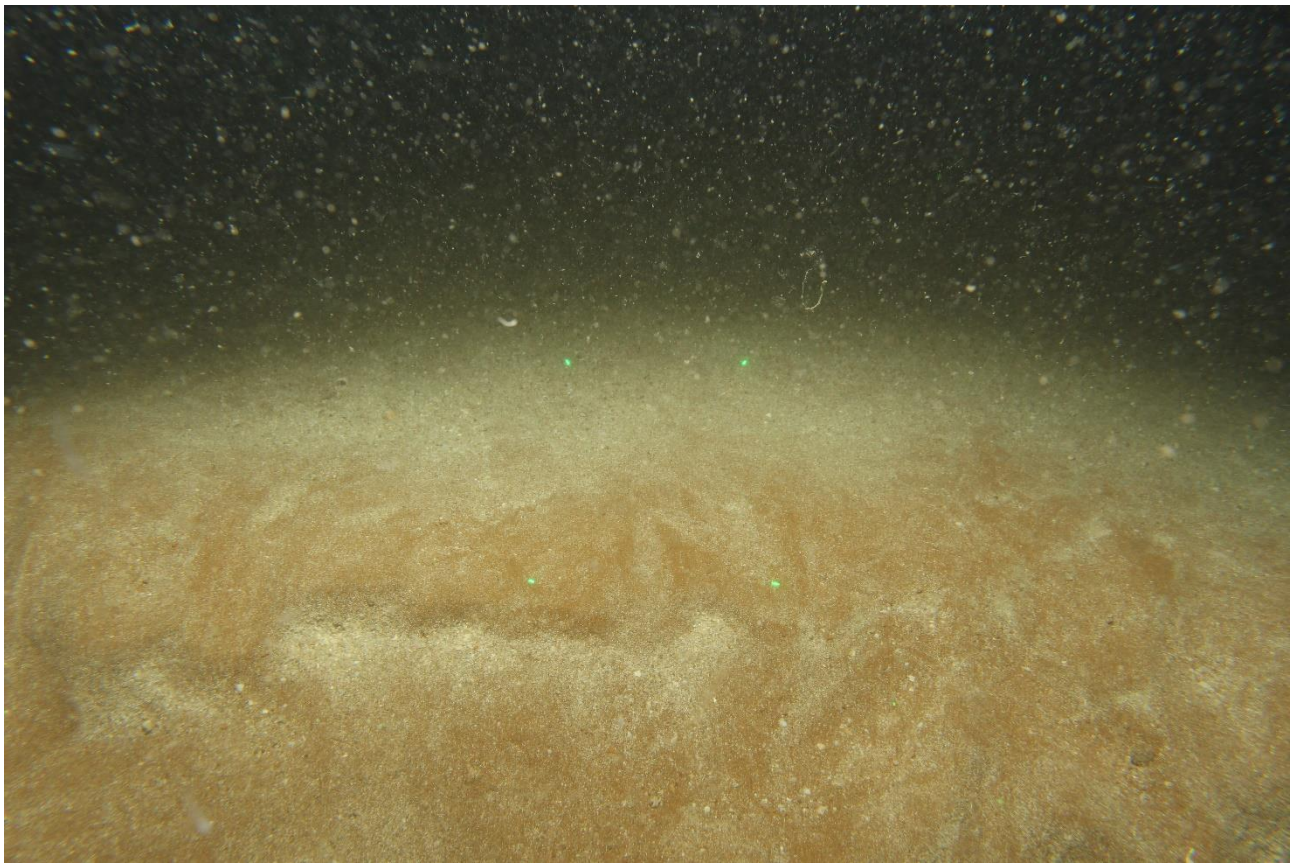


Plate 3-4: A small sand wave at site V11, with coarse, shelly sand at the crest

3.1.1.2 Spoil Ground

The spoil ground sites all consisted of similar soft substrate habitat, which was only identified at one other site along the pipeline (V16). This habitat is defined by silty/clay sediment with medium density biota (soft corals, algae and Bryozoa). Biota commonly associated with this habitat were soft corals (gorgonians, *Junceella* spp. and Alcyoniidae), branching and encrusting sponges, Bryozoa (lace corals), invertebrate burrows, polychaete tubes, brown algae and occasional motile crinoids.

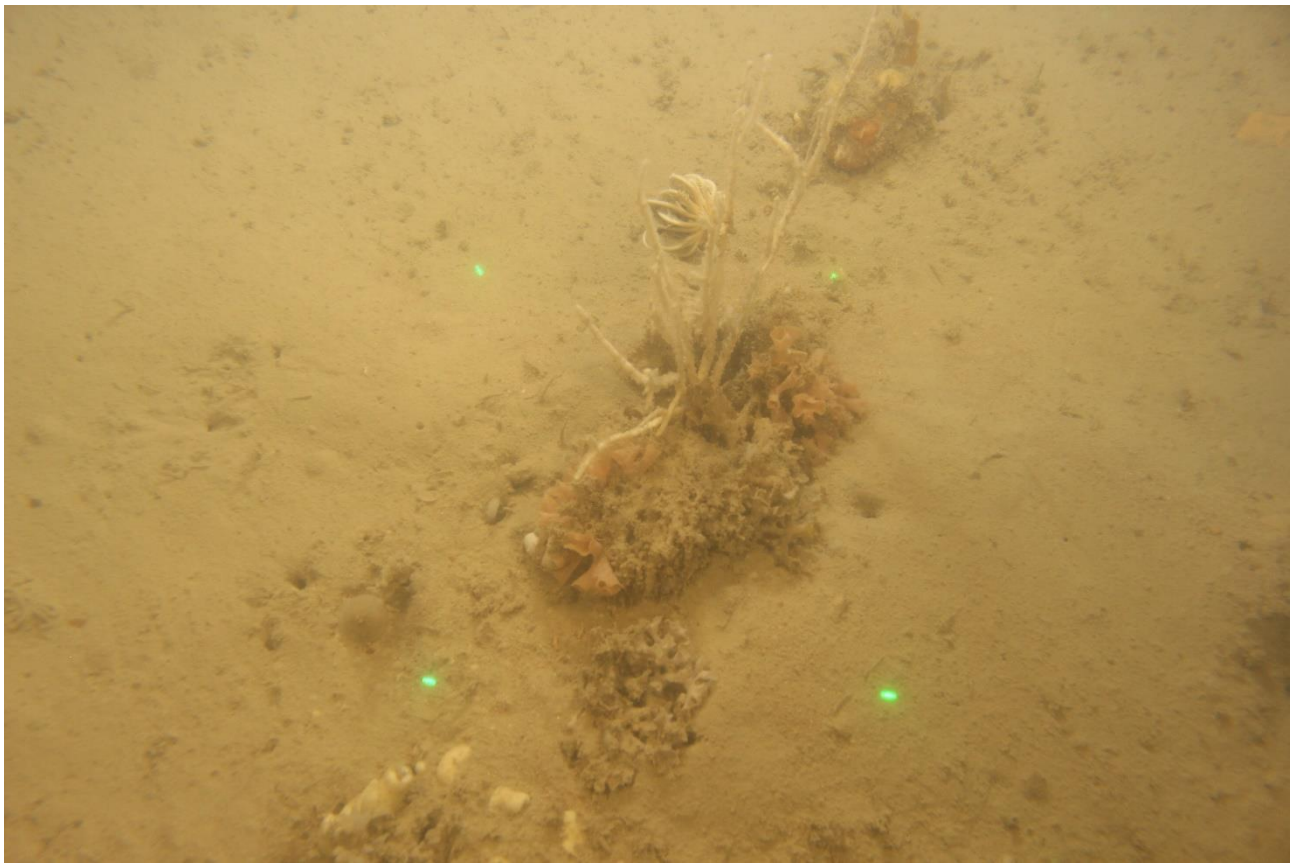


Plate 3-5: Silty/clay sediment with soft corals, Bryozoa (lace coral) and a motile crinoid at site SG10

3.1.1.3 Darwin Harbour

There were three main soft substrate habitat types identified in Darwin Harbour. The first was coarse shelly sand waves, less than 1 m in height with very sparse epibiota (Plate 3-6). This habitat was only recorded at three sites (HS78, HS79 and HS80), all of which were in the potential sand wave dredging zone at the outer edges of Darwin Harbour (Plate 3-7). While this habitat is very sparse in conspicuous epibiota, grab samples from one of the sites in this area (HS33) retrieved a very high density of hermit crabs (Plate 3-8), with over 100 crabs recorded from each grab.

The most common soft substrate habitat type within Darwin harbour consisted of silty, shelly sand, with very sparse soft corals to no conspicuous epibiota (Plate 3-9). The epibiota recorded from this habitat included hydroids, occasional soft corals and sea pens (gorgonians, Pennatulacea, *Junceella* spp. and Alcyoniidae), Bryozoa (lace corals), sea urchins and sea stars.

A mixed habitat of silty shelly sand, with very sparse biota (soft corals) with scattered coral bommies was recorded at only one site, HS51 (Plate 3-10). The coral bommies supported assemblages of hydroids, soft corals (gorgonians), anemone colonies and encrusting sponges.

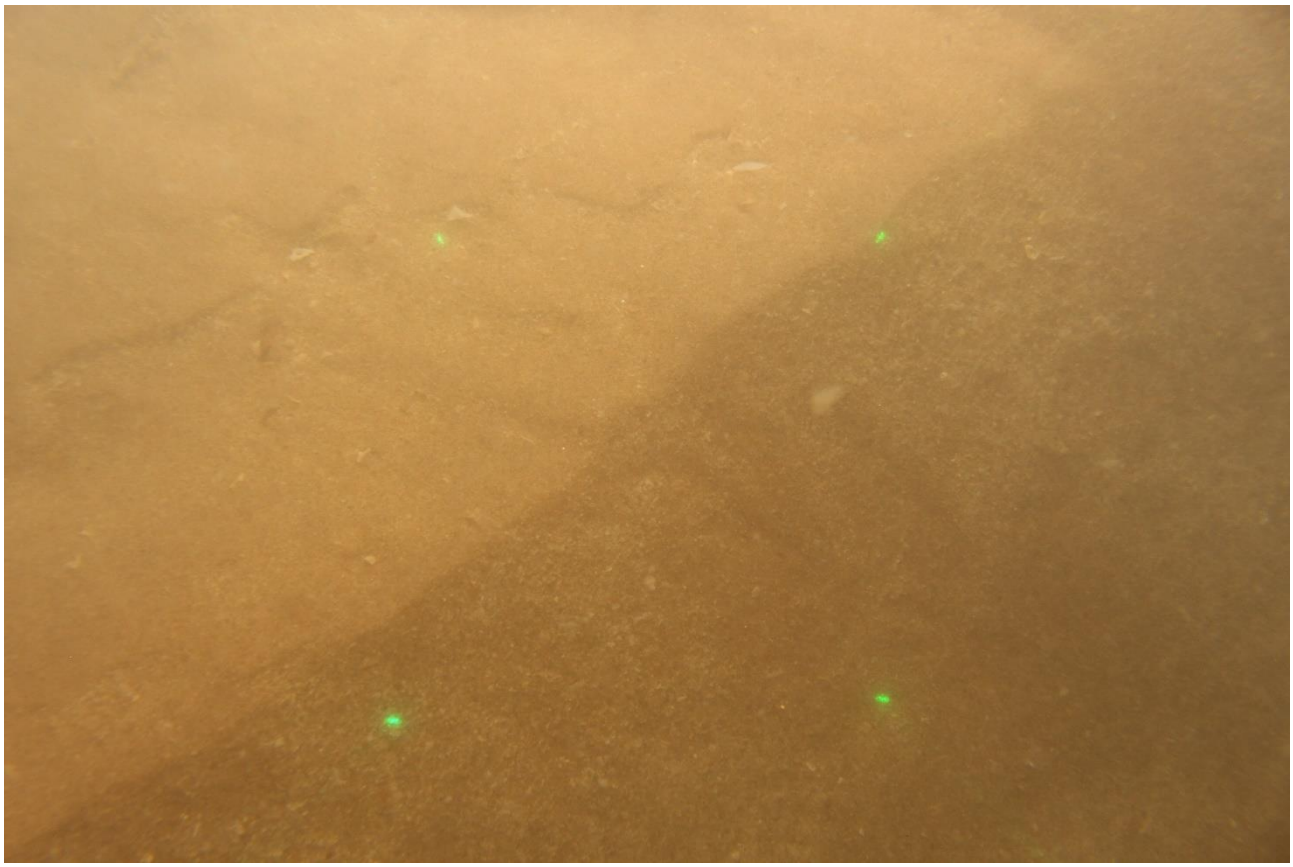


Plate 3-6: Coarse shelly sand waves with very sparse epibiota at site HS78

Plate 3-7: Coarse shelly sand from site HS34, inside the potential sand wave dredging zone at the outer edge of Darwin Harbour

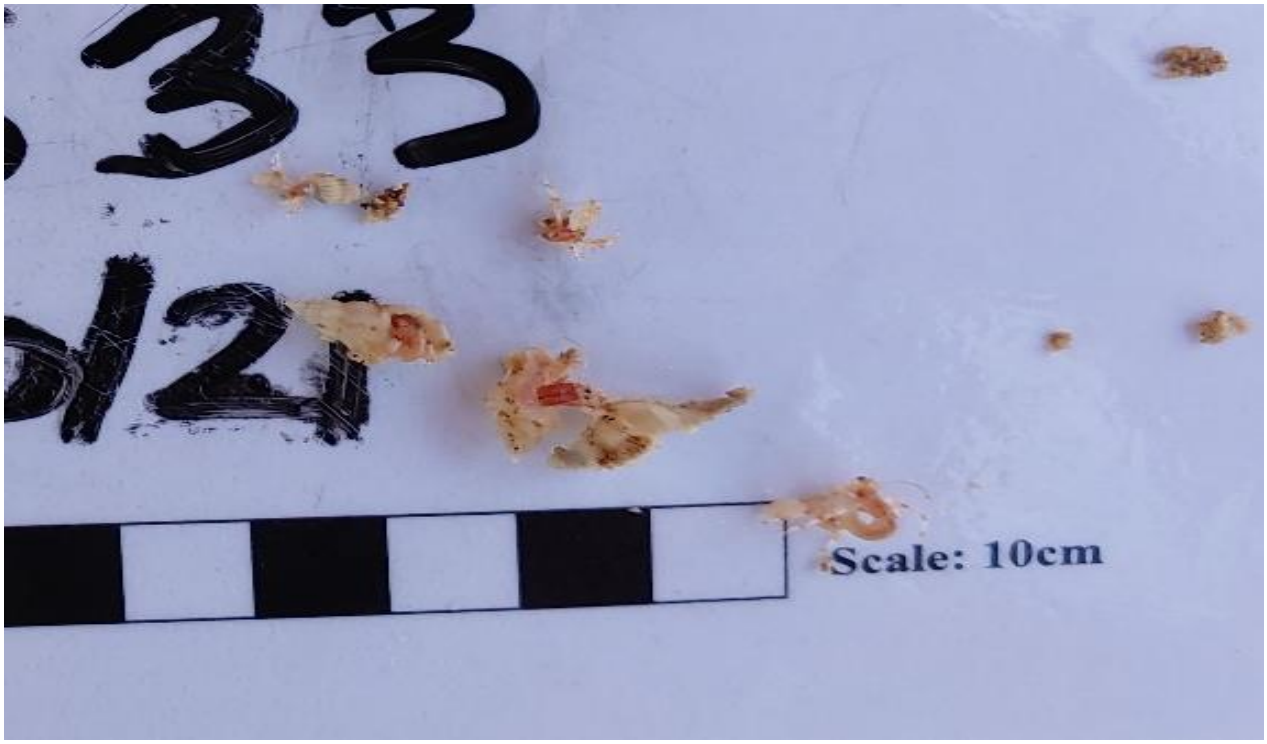


Plate 3-8: Hermit crabs from site HS33

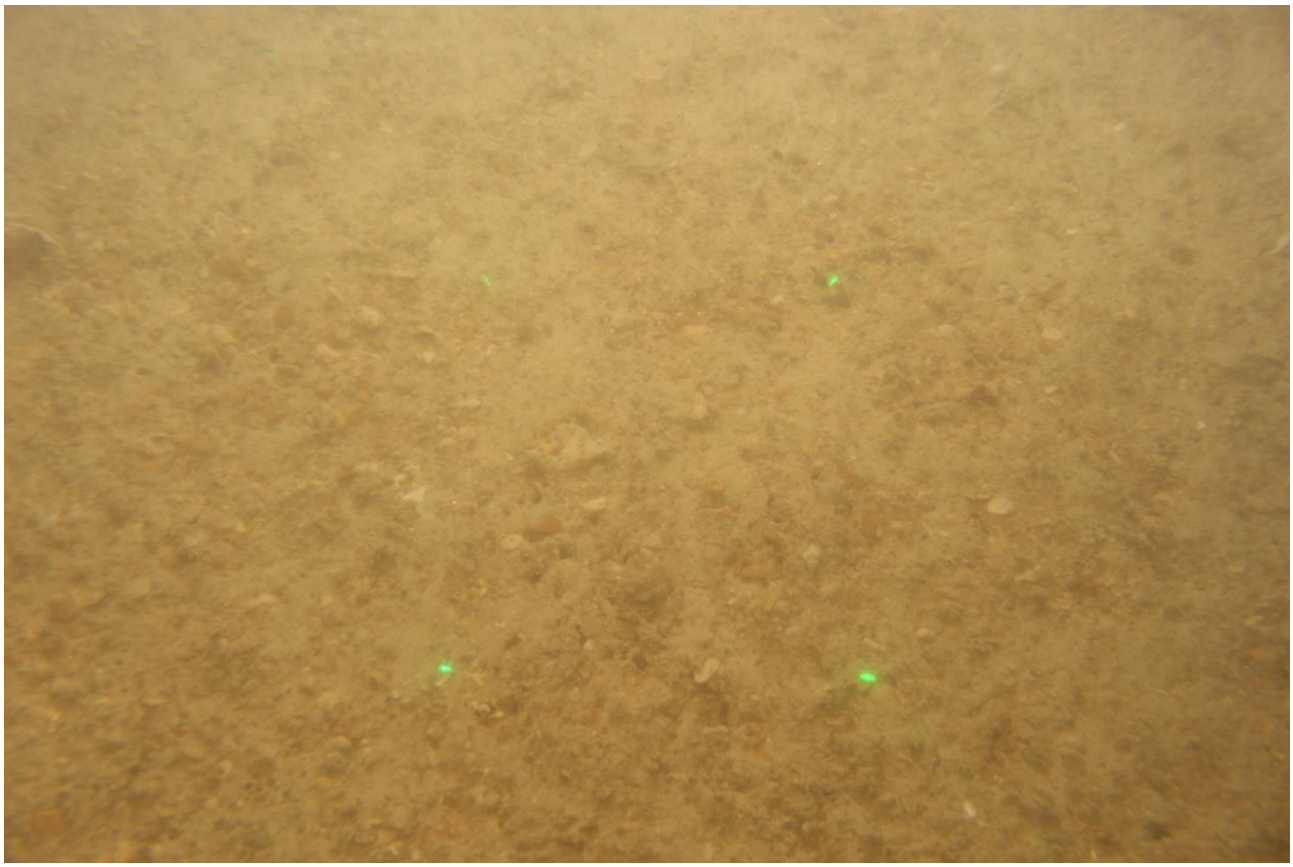


Plate 3-9: Silty shelly sand, with very sparse to no conspicuous epibiota at site HS73

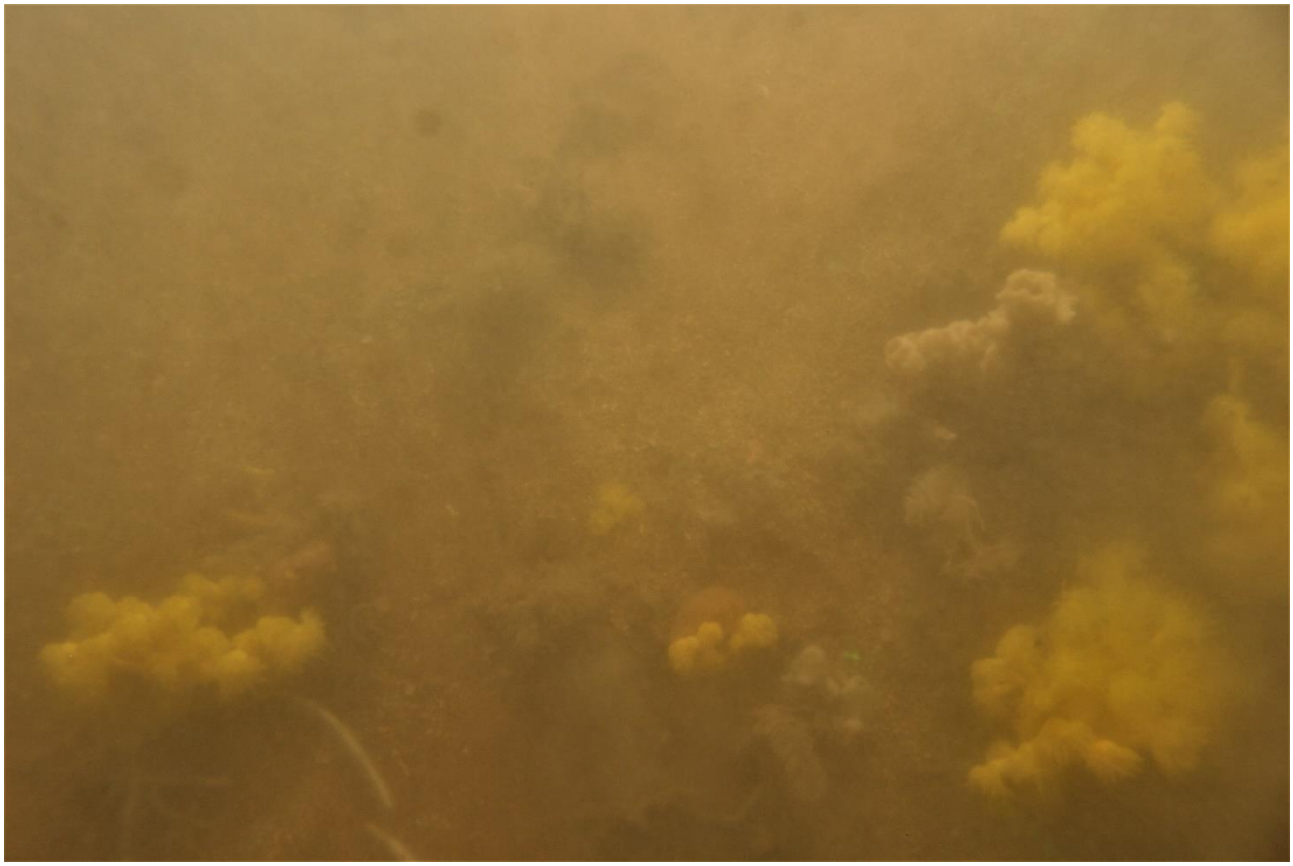


Plate 3-10: Silty shelly sand and part of a coral bommie supporting assemblages of sponges, anemones and soft corals at site HS51

3.1.2 Hard substrate habitats

3.1.2.1 Darwin Harbour

Most of the hard substrates were recorded along the section of the pipeline route offshore from Fanny Bay. Most of these sites were hard bottom (consolidated rocks) with a shelly coarse sediment veneer and sparse to medium conspicuous epibiota (mainly soft corals and bryozoans) (Plate 3-11). However, low profile reef was recorded at sites HS61 and HSN2, with medium to high density epibiota. The epibiota associated with this habitat type included hydroids, soft corals (gorgonians, *Junceella* spp.), brown algae, bryozoans (lace corals), ascidians, and encrusting, digitate and globular sponges.

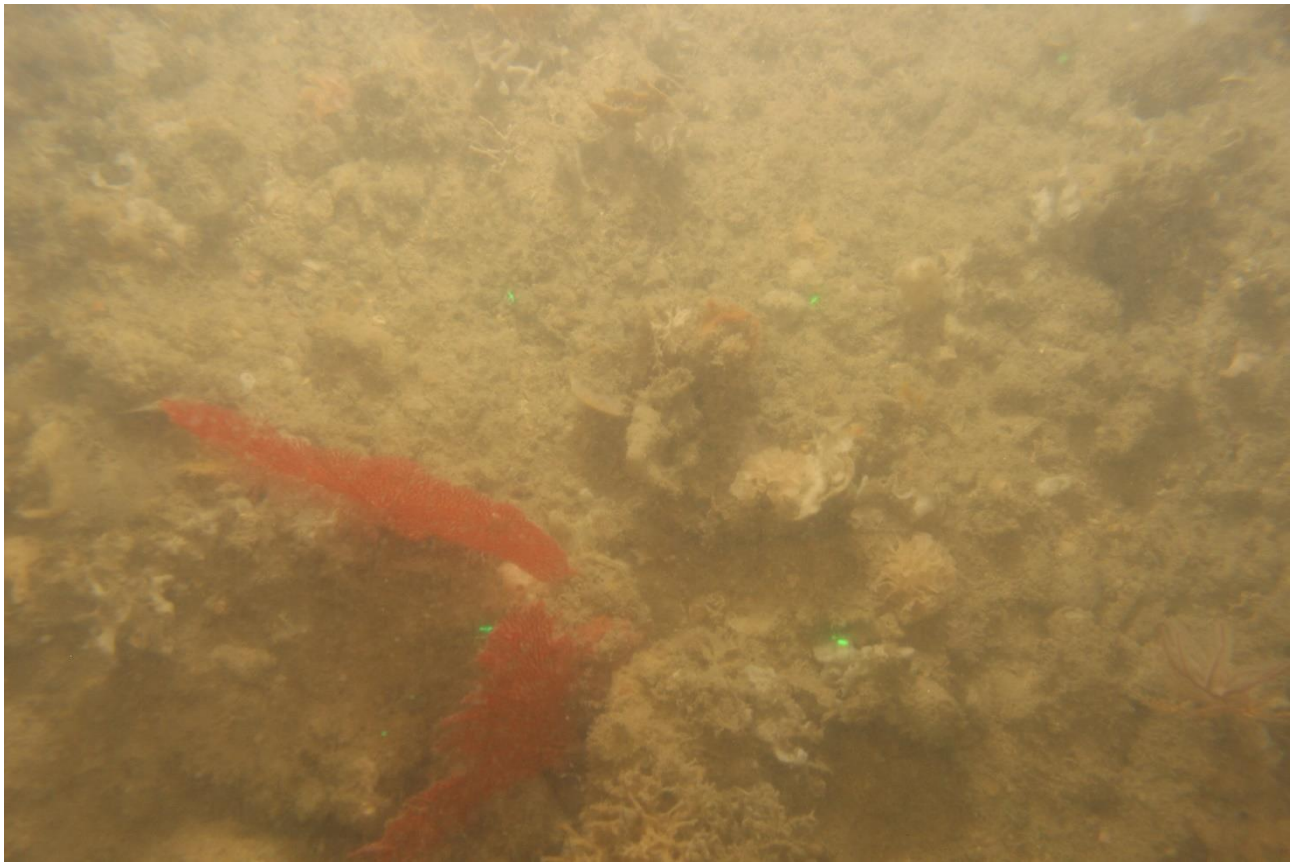


Plate 3-11: Hard bottom (consolidated granite rocks) with a shelly sediment veneer supporting gorgonians and bryozoans (lace corals) at site HS68

Plate 3-12: Low-profile reef with medium density gorgonians and sponges at site HSN2

3.2 Sediment quality

3.2.1 Offshore pipeline

3.2.1.1 Hydrocarbons

The total recoverable hydrocarbons (TRH) and BTEXN concentrations at offshore pipeline sites were below the limit of reporting (LoR) for all samples. Therefore, no polycyclic aromatic hydrocarbon (PAH) analysis was undertaken at these sites.

3.2.2 Darwin Harbour pipeline

3.2.2.1 Hydrocarbons

Total petroleum hydrocarbons (TPH) and total recoverable hydrocarbons (TRH) were detected at 35 of the 53 Darwin Harbour sites, these ranged from <3 to 9 mg/kg (raw data) (Table 3-1). TPH and TRH results were normalised to 1% Total Organic Carbon (TOC). The normalised TPH and TRH concentrations were below the Default Guideline Value (DGV) of 280 mg/kg across all sites (Figure 3-6). Polycyclic aromatic hydrocarbons (PAHs) were requested for these 35 sites. All PAH concentrations were below the LoR.

Table 3-1: Total recoverable hydrocarbons detected above the LOR, normalised to 1 % TOC

Analyte	TOC (%)	C10-C40 (Sum) (mg/kg)	C10-C36 (Sum) (mg/kg)
DGV			280
HS01	0.36	25.00	19.44
HS02	0.34	17.65	14.71
HS03	0.26	30.77	23.08
HS04	0.46	17.39	10.87
HS05	0.55	9.09	7.27
HS06	0.21	42.86	33.33
HS07	0.24	25.00	16.67
HS08	0.24	20.83	12.50
HS09	0.20	60.00	45.00
HS10	0.22	27.27	18.18
HS11	0.22	36.36	27.27
HS13	0.28	14.29	10.71
HS14	0.34	14.71	8.82
HS15	0.31	19.35	16.13
HS16	0.32	12.50	9.38
HS17	0.14	21.43	<3
HS18	0.14	42.86	28.57
Duplicate C	0.22	18.18	<3
HS19	0.19	21.05	<3
HS20	0.20	20.00	<3
HS21	0.26	19.23	15.38
HS22	0.09	55.56	44.44
HS23	0.22	27.27	18.18
HS24	0.14	28.57	<3
HS26	0.19	31.58	21.05
HS31	0.16	25.00	<3
HS70	0.22	22.73	18.18
Duplicate A	0.20	30.00	25.00
HS74	0.18	27.78	16.67
HS75	0.19	42.11	31.58
HS77	0.21	28.57	23.81
HS35	0.13	30.77	<3
HS38	0.15	26.67	20.00
HS42	0.22	22.73	18.18
HS47	0.17	41.18	35.29
HS48	0.35	22.86	17.14
HS49	0.51	19.61	15.69

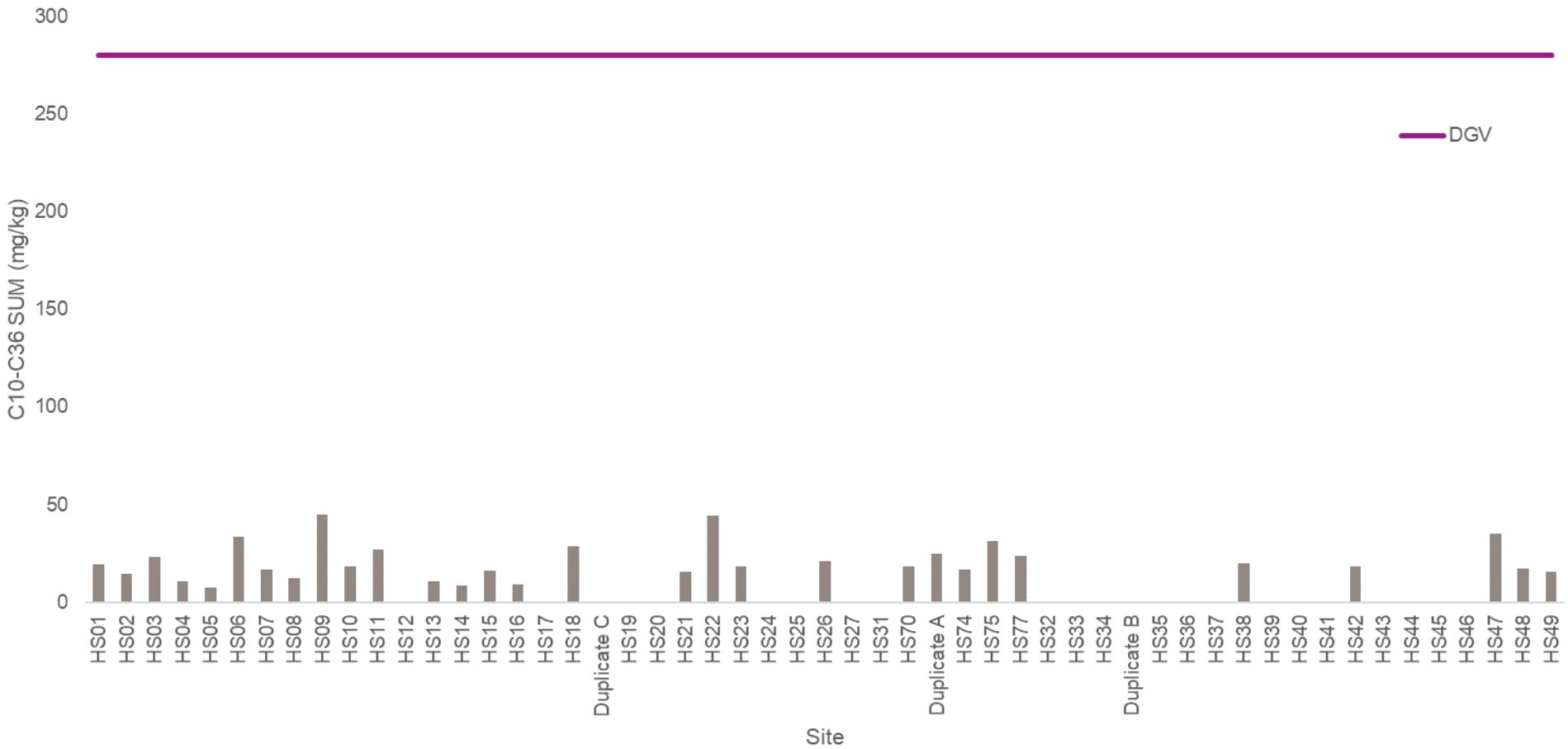


Figure 3-6: Toral recoverable hydrocarbons (normalised to 1% TOC) in Darwin Harbour, from South to North along the pipeline*

*Note duplicate samples were collected from the site directly to the left of the duplicate reference code

3.2.2.2 Metals

The metals and metalloid concentrations for all sites were compared to the Australian & New Zealand Guidelines (ANZG 2018) default guideline values (DGV), where available. Of the metals and metalloids in the sediments sampled from Darwin Harbour; cadmium, mercury and silver were below the LoR for all sites.

Aluminium concentrations were all above the LoR and ranged from 1,330 to 14,600 mg/kg. There is no ANZG (2018) default guideline value (DGV) for aluminium in marine sediments (Figure 3-7). Antimony concentrations were above the LoR at 18 sites, ranging from <0.5 to 1.07 mg/kg (Figure 3-7). All the sites in the potential sand wave dredging area were below the LoR. All samples were below the ANZG (2018) default guideline value (DGV) of 2 mg/kg (Figure 3-7).

Arsenic concentrations were found to be very high inside Darwin Harbour. All samples were above the LoR, and only seven samples were below the ANZG (2018) DGV of 20 mg/kg., all of which were within the potential sand wave dredging area. Arsenic concentrations ranged from 8.27 to 108 mg/kg, with a total of nine samples (HS06, HS07, HS08, HS09, HS10, HS11, HS12, HS20 and HS24) above the ANZG (2018) high guideline value (GV-High) of 70 mg/kg (Figure 3-7).

Chromium concentrations were above the LoR at all sites and ranged from 6.9 to 114 mg/kg. Only one sample (HS31) was above the ANZG (2018) DGV of 80 mg/kg (Figure 3-7).

Cobalt concentrations were above the LoR at all sites, ranging from 1 to 10.9 mg/kg. There is no ANZG (2018) DGV for cobalt in marine sediments. Cobalt concentrations were generally high at the southern end of the pipeline, with lower concentrations found within the potential sand wave dredging area (Figure 3-7).

Eleven sites had copper concentrations below the LoR. These sites were all within the potential sand wave dredging area. Copper concentrations within Darwin Harbour ranged from <1 to 7.6 mg/kg. All sites were well below the ANZG (2018) DGV of 65 mg/kg (Figure 3-7).

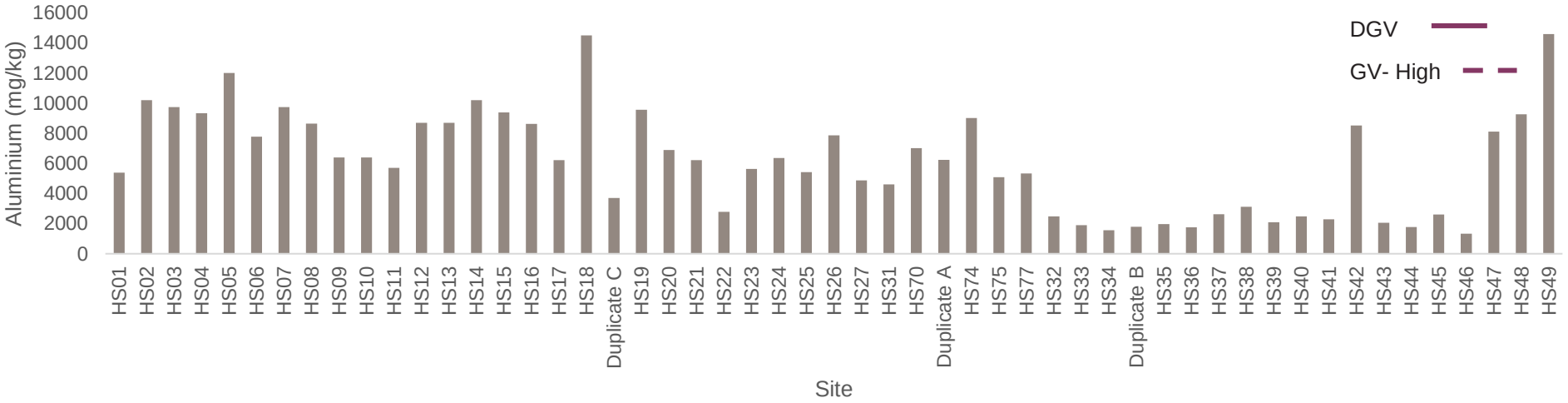
Iron concentrations were all above the LoR at all sites and ranged from 8,140 to 58,100 mg/kg. There is no ANZG (2018) DGV for iron in marine sediments. Iron concentrations were lowest within the potential sand wave dredge area (Figure 3-7).

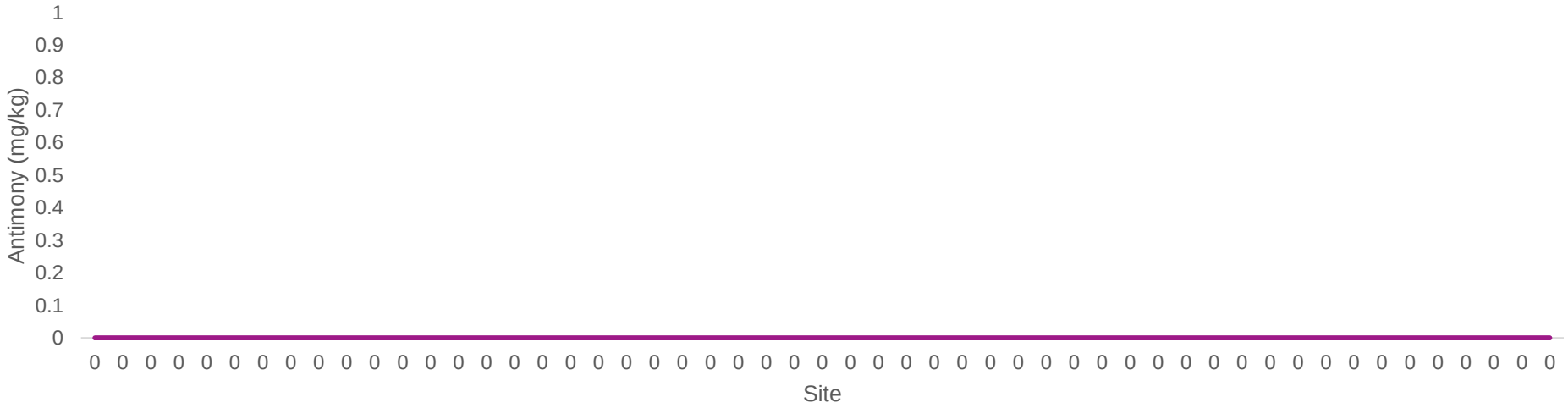
Lead concentrations were all above the LoR and ranged from 1.6 to 28 mg/kg. All sites were below the ANZG (2018) DGV of 50 mg/kg. Lead concentrations were slightly lower within the sand wave dredge area (Figure 3-7).

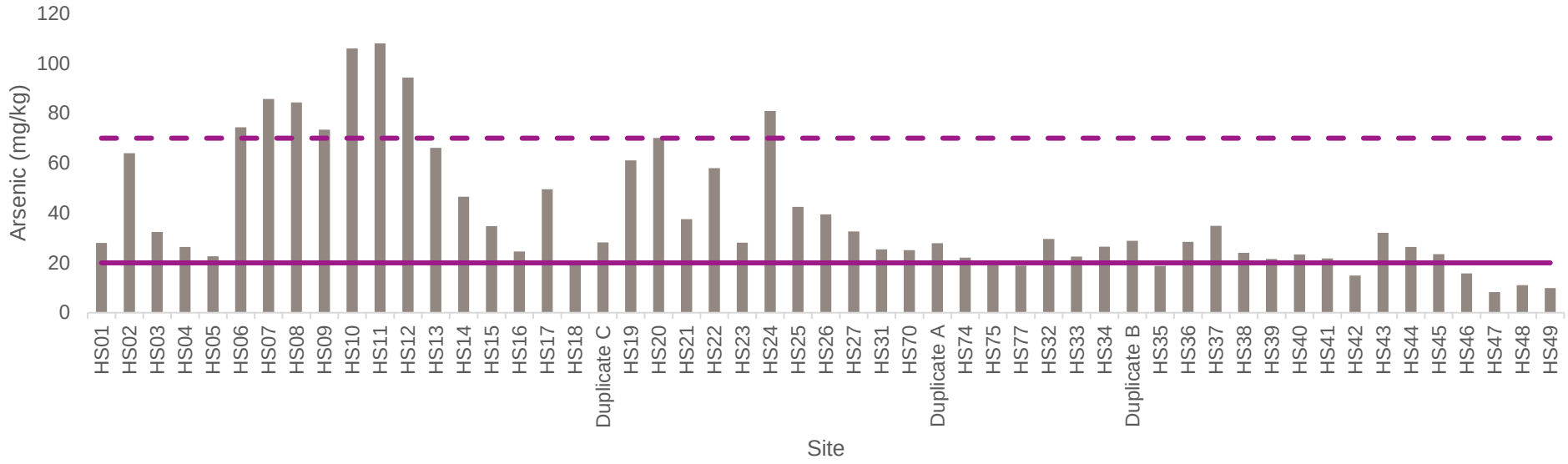
Manganese concentrations were variable across Darwin Harbour but were generally high within the proposed sand wave dredging area. Manganese concentrations were all above the LoR and ranged from 169 to 800 mg/kg (Figure 3-7). There is no ANZG (2018) DGV for manganese in marine sediments.

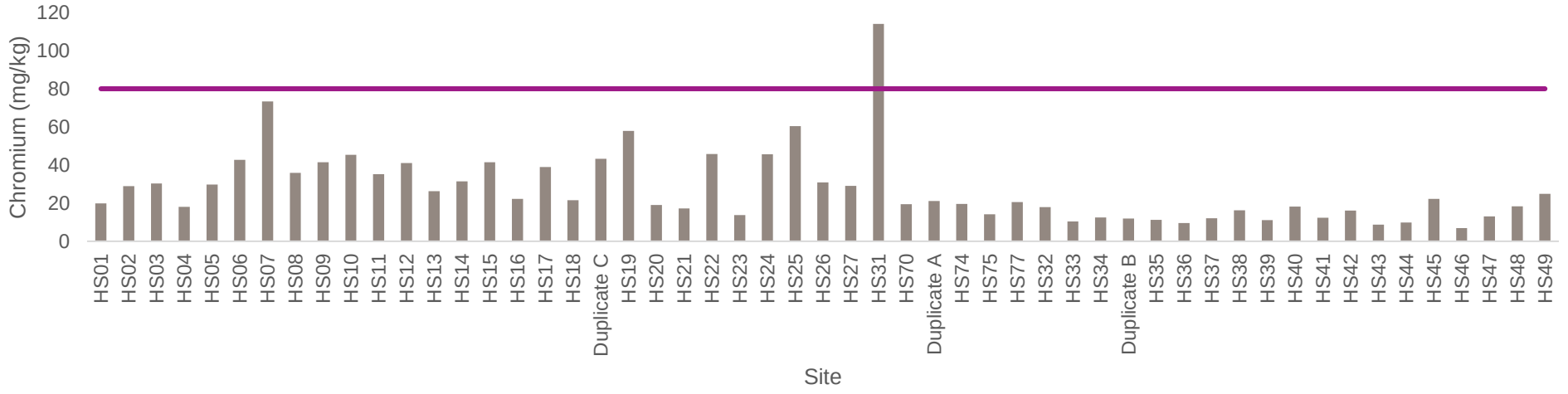
Nickel concentrations were all above the LoR at all sites and ranged from 1.6 to 9.8 mg/kg. All sites were below the ANZG (2018) DGV of 21 mg/kg (Figure 3-7).

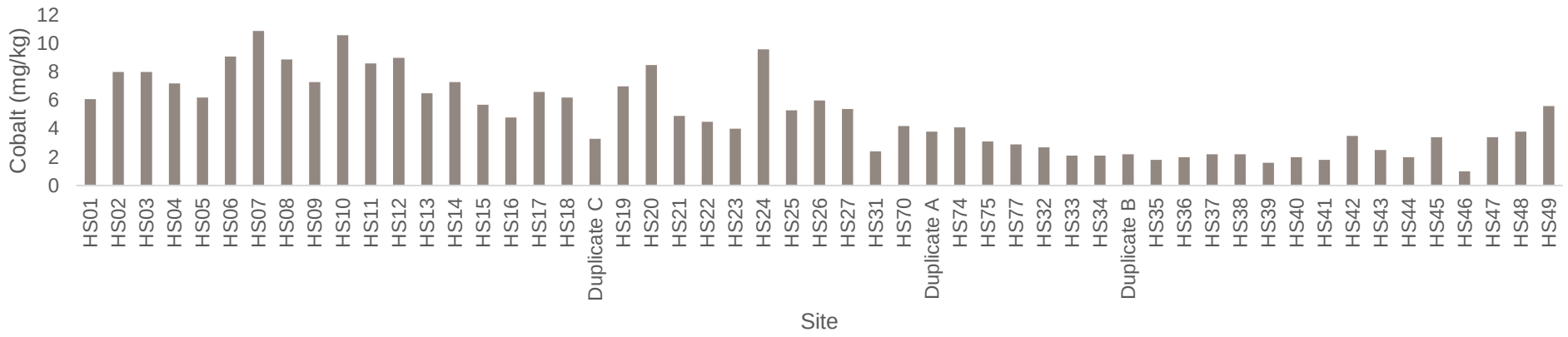
Zinc concentrations were all above the LoR at all sites and ranged from 2 to 20.3 mg/kg. All sites were all below the ANZG (2018) DGV of 200 mg/kg (Figure 3-7).

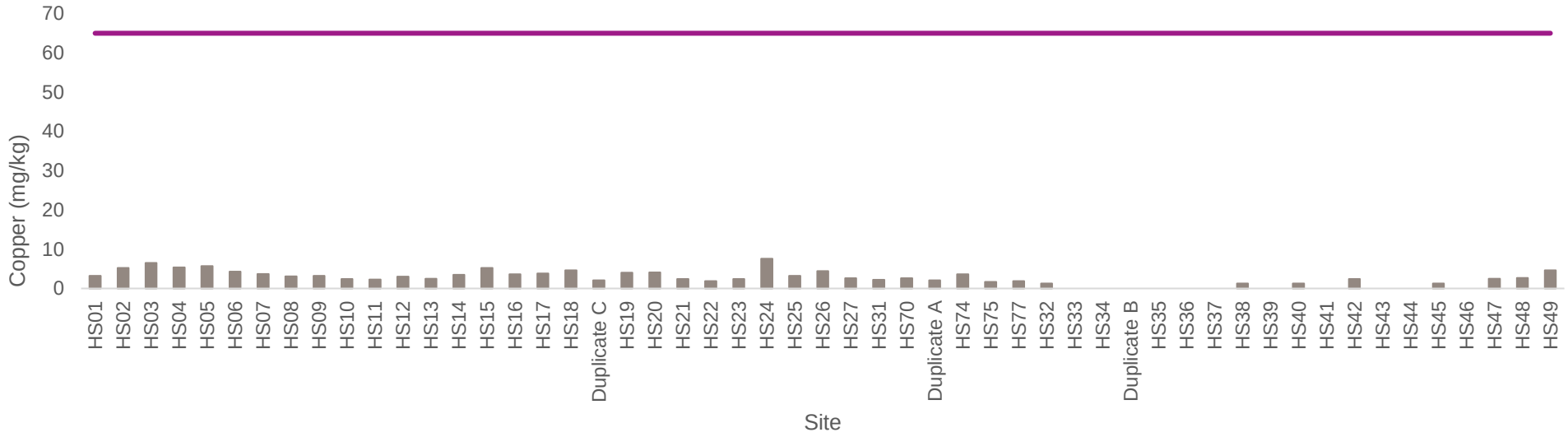

Aluminium (mg/kg)
16000
14000
12000
10000
8000
6000
4000
2000
0
DGV
GV- High
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site

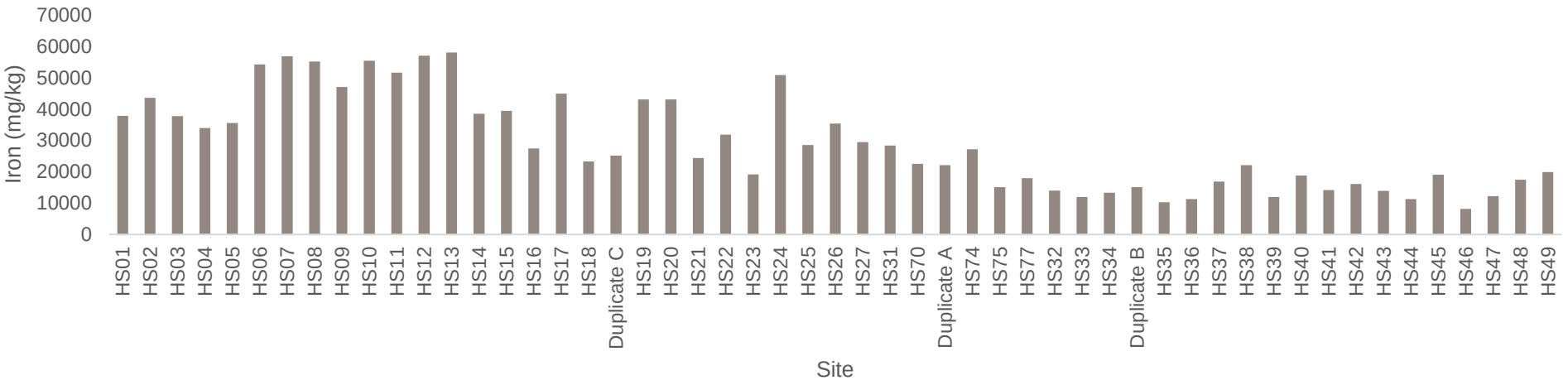

Antimony (mg/kg)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Site

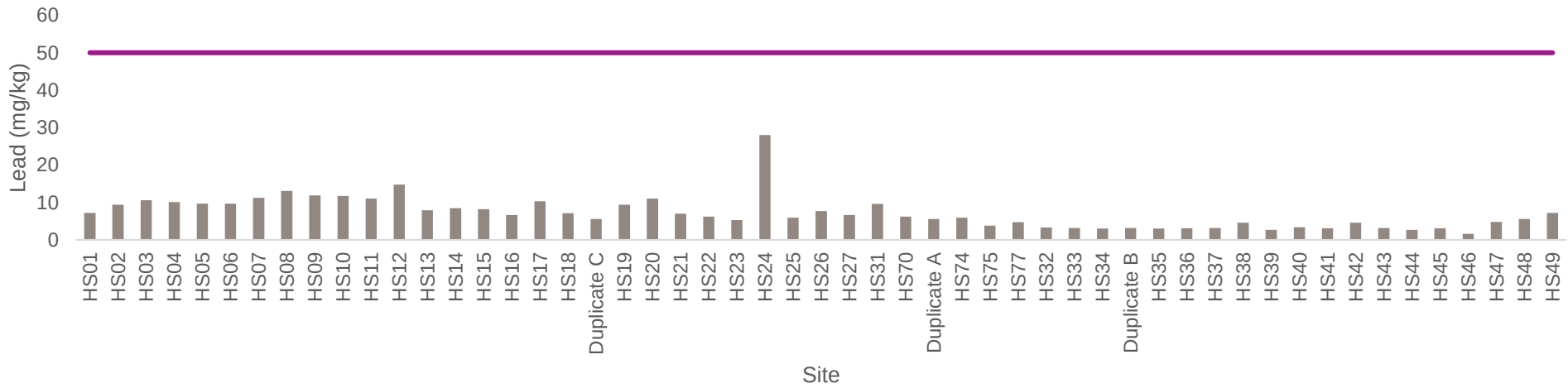

Arsenic (mg/kg)
120
100
80
60
40
20
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site

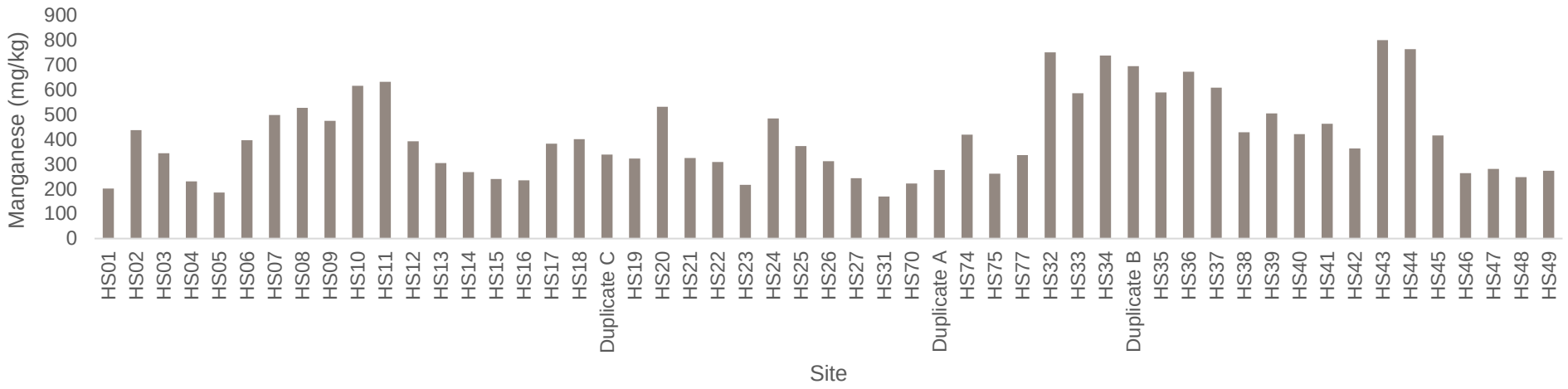

Chromium (mg/kg)
120
100
80
60
40
20
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site

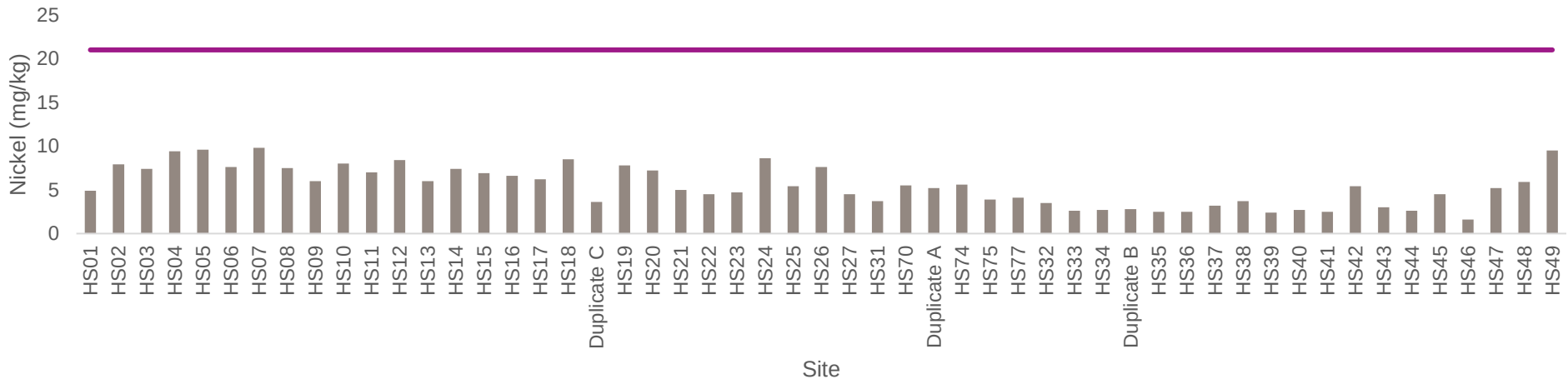

Cobalt (mg/kg)
12
10
8
6
4
2
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site


Copper (mg/kg)
70
60
50
40
30
20
10
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site


Iron (mg/kg)
70000
60000
50000
40000
30000
20000
10000
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site


Lead (mg/kg)
60
50
40
30
20
10
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site


Manganese (mg/kg)
900
800
700
600
500
400
300
200
100
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site


Nickel (mg/kg)
25
20
15
10
5
0
HS01 HS02 HS03 HS04 HS05 HS06 HS07 HS08 HS09 HS10 HS11 HS12 HS13 HS14 HS15 HS16 HS17 HS18 Duplicate C HS19 HS20 HS21 HS22 HS23 HS24 HS25 HS26 HS27 HS31 HS70 Duplicate A HS74 HS75 HS77 HS32 HS33 HS34 Duplicate B HS35 HS36 HS37 HS38 HS39 HS40 HS41 HS42 HS43 HS44 HS45 HS46 HS47 HS48 HS49
Site

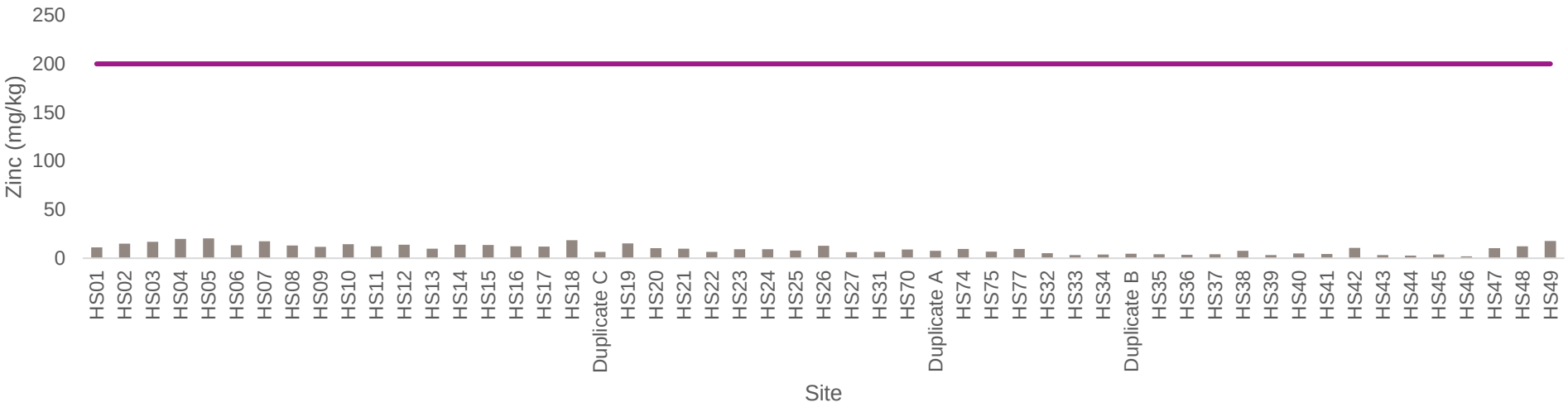


Figure 3-7: Metal concentrations along the Darwin Harbour section of the pipeline route (from South to North)

Arsenic is considered to become concentrated in sedimentary rocks through sedimentation processes. Studies have shown that iron formations and iron rich sediments can contain very large concentrations of natural arsenic (Tanaka, 1988). Arsenic concentrations were therefore plotted against iron concentrations in Darwin Harbour to determine if there was a correlation between arsenic and iron. A strong positive polynomial correlation between iron concentrations and arsenic concentrations was identified (R^2 value of 0.76) (Figure 3-8). This indicated that the higher arsenic concentrations in Darwin Harbour were likely natural (relating to geological sources), rather than anthropogenic in origin.

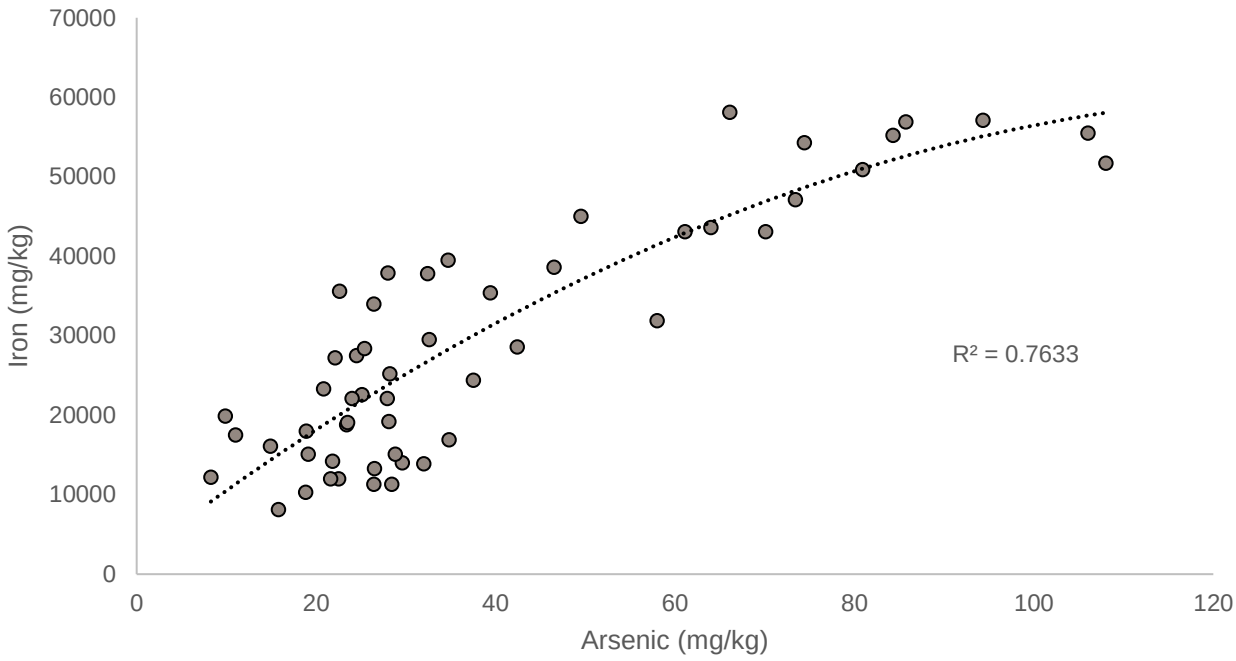


Figure 3-8: The correlation between iron and arsenic concentrations inside Darwin Harbour

3.2.2.3 Nutrients

Total Kjeldahl nitrogen (TKN) concentrations exhibited high concentrations and variability across sites. TKN in Darwin Harbour ranged from 20 to 540 mg/kg. Total phosphorus (TP) concentrations also exhibited high concentrations and variability across sites, ranging from 86 to 1,130 mg/kg. TKN and TP concentrations were generally lower within the proposed sand wave dredging area.

Table 3-2: Total Kjeldahl nitrogen and Total Phosphorus concentrations in Darwin Harbour

Site	Total Kjeldahl Nitrogen as N (mg/kg)	Total Phosphorus as P (mg/kg)
HS01	280	549
HS02	350	428
HS03	380	540
HS04	370	297
HS05	540	416
HS06	180	1120
HS07	300	635
HS08	330	834
HS09	300	589
HS10	330	631
HS11	270	697
HS12	290	1130

HS13	360	661
HS14	310	555
HS15	270	322
HS16	270	485
HS17	280	483
HS18	480	696
Duplicate C	270	319
HS19	260	626
HS20	130	569
HS21	250	422
HS22	220	704
HS23	220	482
HS24	120	758
HS25	150	499
HS26	240	394
HS27	190	152
HS31	160	86
HS70	180	244
Duplicate A	220	398
HS74	380	508
HS75	240	553
HS77	410	270
HS32	80	331
HS33	110	344
HS34	90	408
Duplicate B	60	371
HS35	180	317
HS36	60	338
HS37	20	219
HS38	160	281
HS39	50	250
HS40	100	308
HS41	230	197
HS42	180	403
HS43	40	291
HS44	40	256
HS45	40	212
HS46	30	200
HS47	270	353
HS48	300	310
HS49	470	341

3.2.2.4 Pesticides

Pesticide analysis was undertaken for 33 out of the 53 Darwin Harbour sediment samples. All pesticide chemicals analysed were below the LoR across all sites.

3.2.3 Spoil ground

3.2.3.1 Hydrocarbons

The offshore pipeline total recoverable hydrocarbons (TRH) and BTEXN concentrations were below the limit of reporting (LoR) for all samples. The offshore pipeline samples were, therefore, not tested for polycyclic aromatic hydrocarbons (PAHs).

3.3 Water quality

3.3.1 Offshore pipeline

3.3.1.1 Hydrocarbons

The offshore pipeline total recoverable hydrocarbon (TRH) and BTEXN concentrations were below the limit of reporting (LoR) for all samples (Appendix B). The offshore pipeline samples were, therefore, not tested for polycyclic aromatic hydrocarbons (PAHs).

3.3.1.2 Metals

Five of the filtered and unfiltered metals and metalloids were below the LoR for all sites, except OP1S. These were cadmium (Cd), chromium (Cr), cobalt (Co), nickel (Ni) and mercury (Hg). OPS1 had filtered nickel and unfiltered chromium concentrations that were above the LoR (1.5 µg/L and 0.3 µg/L, respectively).

Filtered and unfiltered copper (Cu) concentrations ranged from <0.2 to 8.4 µg/L (Figure 3-9). Three of the copper samples were above the ANZG (2018) DGV of 1.3 µg/L, in slightly to moderately disturbed marine offshore ecosystems, at the 95% species protection level (Figure 3-9). These results were for unfiltered copper at OP1S and Triplicate B (taken from sample OP8S), and for filtered metals at OP2S. The highest filtered copper concentration was recorded at OP2S (8.4 µg/L), while all other samples had copper concentrations under 1.6 µg/L.

Unfiltered zinc (Zn) concentrations ranged from <1 to 9 µg/L and were at or above the ANZG (2018) DGV of 8 µg/L at two sites (OP1S and OP5S). Filtered zinc concentrations ranged from 1 to 9 µg/L, with three samples being at or above the DGV (Figure 3-9).

The filtered and unfiltered arsenic (As) concentrations were very similar. Samples ranged from 1.3 to 1.9 µg/L, with all recorded concentrations below the ANZG (2018) DGV of 4.5 µg/L (Figure 3-9).

Filtered and unfiltered lead (Pb) concentrations ranged from <0.1 to 5.4 µg/L (Figure 3-9). Ten unfiltered lead samples below the LoR, whilst six filtered lead samples were below the LoR. One sample of filtered lead (OP5S) was above the ANZG (2018) DGV of 4.4 µg/L in slightly to moderately disturbed marine offshore ecosystems, at the 95% species protection level.

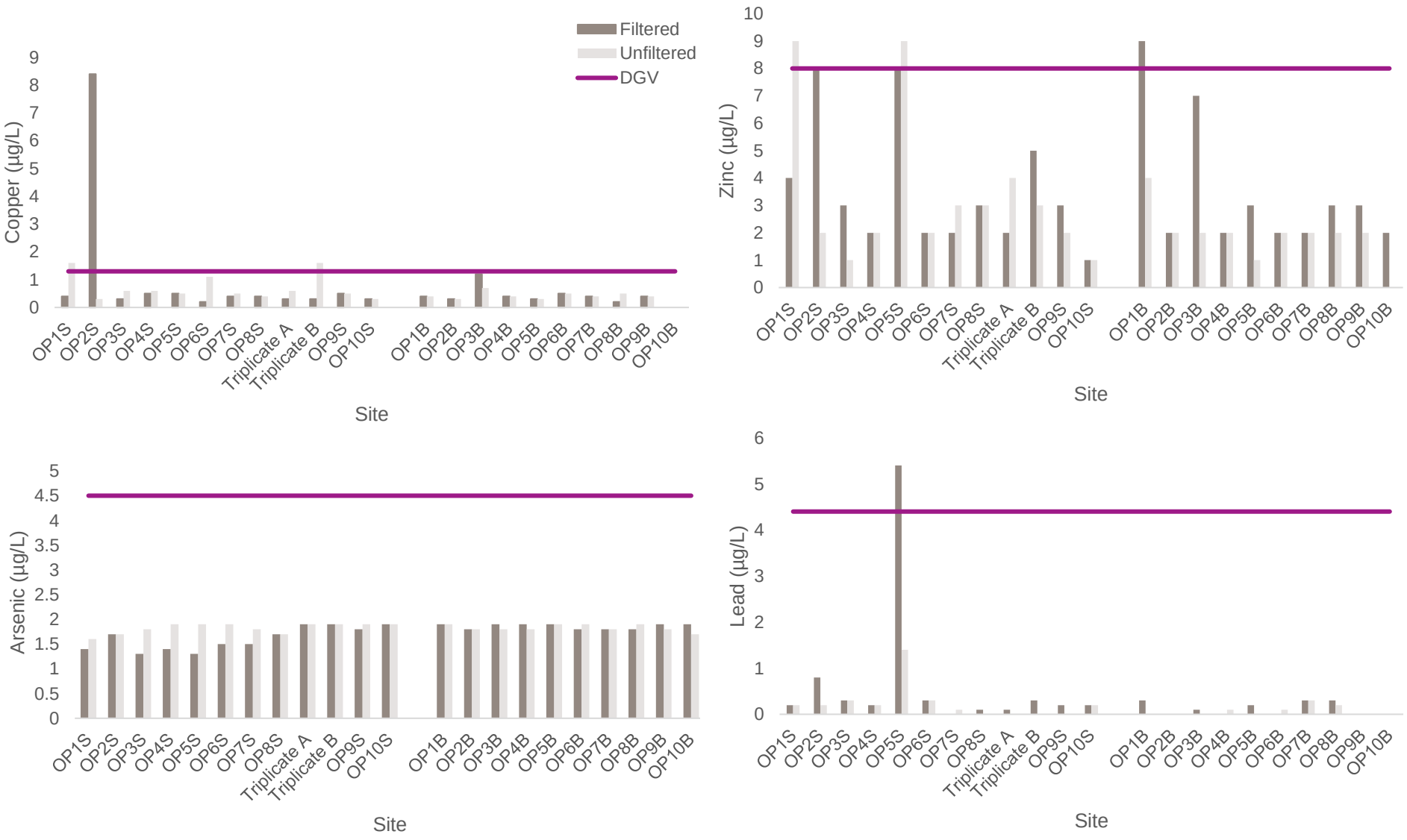


Figure 3-9: Filtered and unfiltered metal concentrations above LoRs from the Offshore Pipeline route (from south to north)

3.3.1.3 Nutrients and pigments

3.3.1.3.1 Nitrogen

The test for total nitrogen provided data for all nitrogen compounds in the water samples, namely nitrite (NO_2), nitrate (NO_3), ammonia (NH_4+) and organic nitrogen compounds.

Nitrite and nitrate were recorded at detectable levels at all sites, except for site OP8S/B. Nitrite and nitrate were recorded in bottom water samples only, with all surface samples being below the LoR. Nitrite and nitrate were recorded at concentrations of <2 to 15 µg.N/L in the bottom water samples.

Ammonia was detected in 11 samples, with ten of those being bottom (near seabed) samples. Only one surface sample had detectable concentrations of Ammonia (OP5S), with a concentration of 7 µg.N/L being recorded from this sample. All samples were below the ANZG (2018) default species protection guideline value of 910 µg.N/L for ammonia in slightly to moderately disturbed marine offshore ecosystems, which have a 95% species protection level.

Total nitrogen concentrations indicated the presence of other organic nitrogen compounds, with no samples (excluding the field and transport blanks) being below the LoR concentration of 50 µg.N/L. Total nitrogen concentrations ranged from 80 to 150 µg.N/L. There were 20 samples that were found to have met or exceeded the ANZG (2018) DGV of 100 µg.N/L for total nitrogen in slightly disturbed tropical Australian marine offshore ecosystems (Figure 3-10).

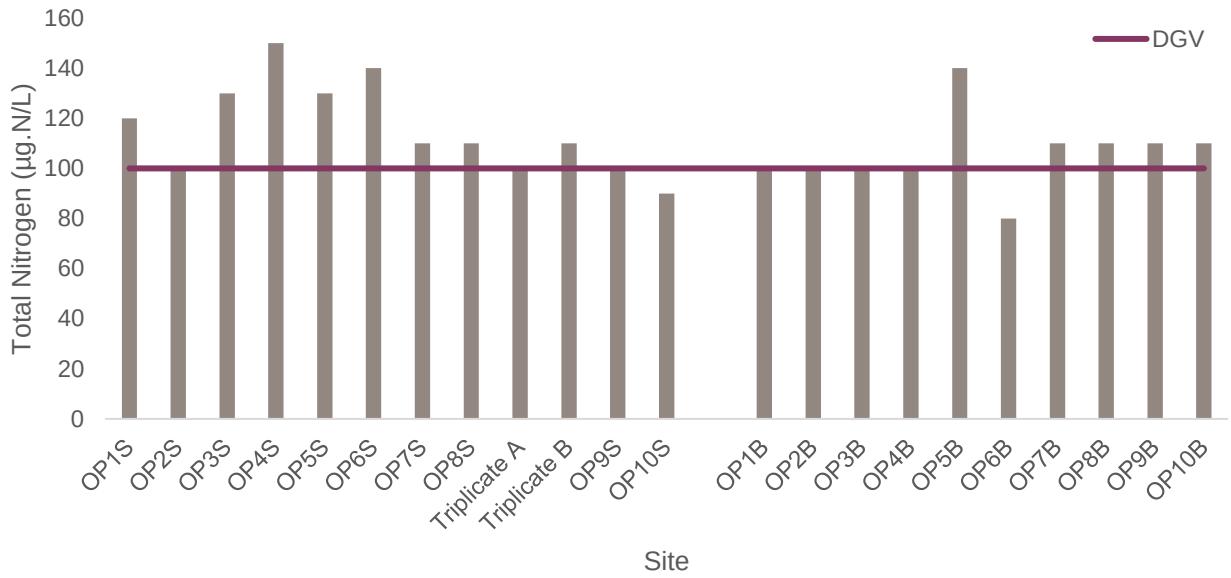


Figure 3-10: Surface and bottom total nitrogen concentrations along the offshore pipeline route

3.3.1.3.2 Phosphorus

The results for total phosphorus comprise the concentration of phosphorus that occurs in orthophosphate and organic phosphate compounds.

Orthophosphate (filterable reactive phosphorus) concentrations ranged from <2 to 8 µg.P/L. All but two samples were above the LoR, and both of these samples were surface samples (OP3S and OP4S). Eight samples exceeded the ANZG (2018) DGV of 5 µg.P/L for orthophosphate in slightly disturbed tropical Australian marine offshore ecosystems.

Total phosphorous concentrations ranged from 9 to 17 µg.P/L. Almost all samples, with the exception of three surface samples (OP1S, OP2S and OP3S), met or exceeded the ANZG (2018) DGV of 10 µg.P/L for total phosphorus in slightly disturbed tropical Australian marine offshore ecosystems (Figure 3-11).

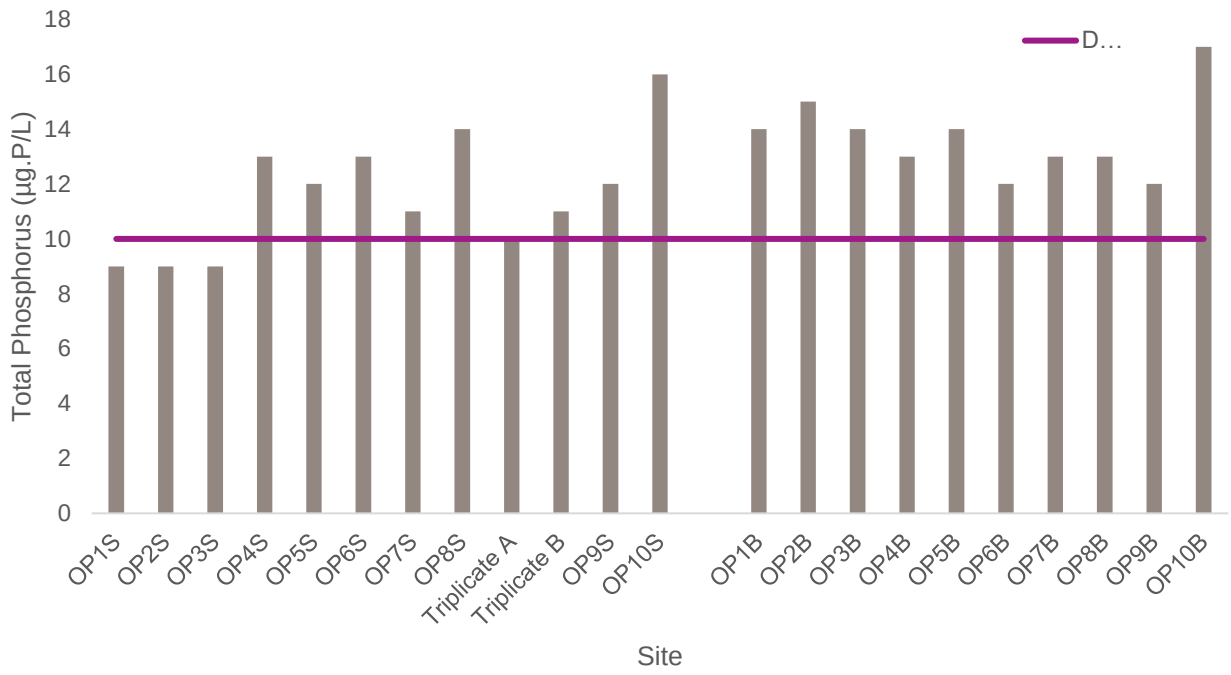


Figure 3-11: Surface and bottom total phosphorus concentrations along the offshore pipeline route

3.3.1.3.3 Pigments

Chlorophyll-a concentrations were used as an indicator of the likely level of phytoplankton biomass across the offshore pipeline area. Chlorophyll-a concentrations ranged from 0.4 to 1.5 µg/L (Figure 3-12). All concentrations were below the ANZG (2018) default guideline value of 9 µg/L for chlorophyll-a in slightly disturbed tropical Australian marine offshore ecosystems. Concentrations were variable across surface and bottom samples.

Phaeophytin-a was also sampled as this pigment is a breakdown product of chlorophyll-a and can be used to indicate if phytoplankton are blooming or declining. Phaeophytin-a was detected in 10 samples, the majority of which were at the surface (Figure 3-12). Concentrations ranged from <0.2 µg/L (i.e., below the LoR) to 0.6 µg/L. There is no ANZG (2018) default guideline value for phaeophytin-a.

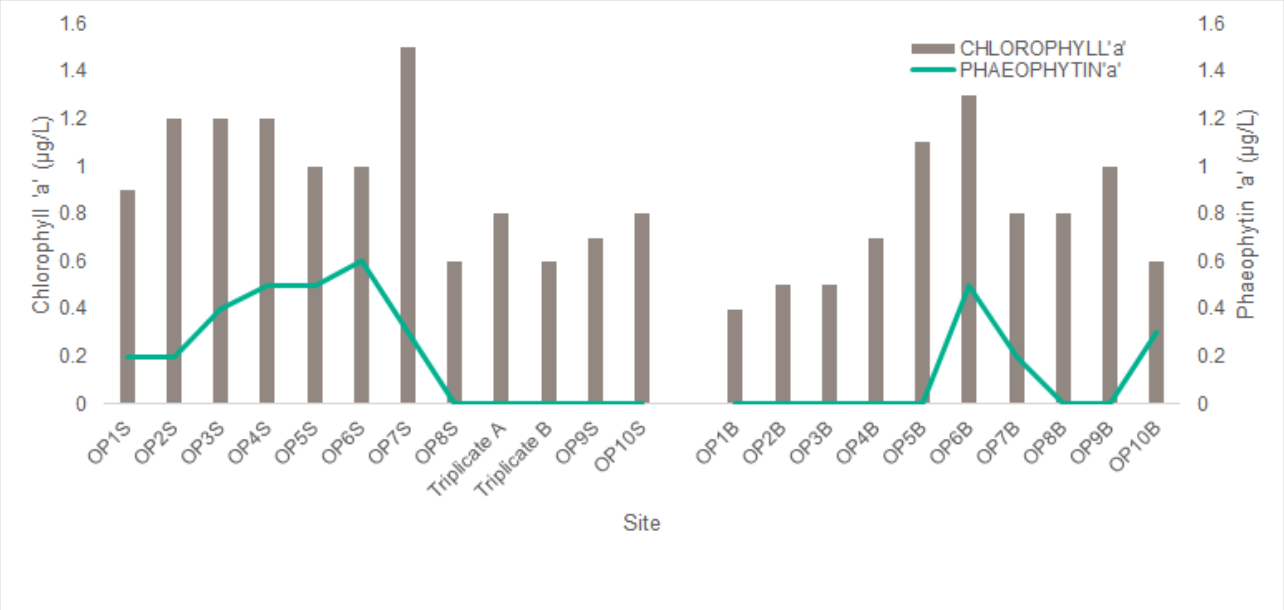


Figure 3-12: Surface and bottom Chlorophyll-a and Phaeophytin-a concentrations along the offshore pipeline route

3.3.1.3.4 Total suspended solids

Total suspended solid (TSS) concentrations were all above the LoR (0.5 mg/L) and ranged from 1.7 to 8.6 mg/L. Most sites had TSS between 1.7 and 4 mg/L, however site OP10S/B was much higher, with 8.6 mg/L at the surface and 7.7 mg/L at the bottom. OP10S/B was the closest water quality site to Darwin Harbour but was sampled on an incoming tide. There was no correlation between depth and TSS.

3.3.2 Spoil Ground

3.3.2.1 Hydrocarbons

The offshore pipeline total recoverable hydrocarbon (TRH) and BTEXN concentrations were below the LoR for all samples (Appendix B). The offshore pipeline samples were, therefore, not tested for polycyclic aromatic hydrocarbons (PAHs).

3.3.2.2 Metals

Five of the filtered and unfiltered metals and metalloids were below the LoR concentrations for all sites. These were cadmium (Cd), chromium (Cr), cobalt (Co), nickel (Ni) and mercury (Hg). Due to an issue with the sample jar, unfiltered metals were not analysed for Triplicate D.

Filtered and unfiltered copper (Cu) concentrations ranged from <0.2 to 0.6 µg/L (Figure 3-13). Only two unfiltered copper samples were below the LoR (Triplicate C and SG7B), while five filtered copper samples were below the LoR (SG12S, Triplicate D, SG13S, SG4S and SG7B). None of the copper samples were above the ANZG (2018) DGV of 1.3 µg/L, in slightly to moderately disturbed marine offshore ecosystems, which have a 95% species protection level (Figure 3-13).

Unfiltered zinc (Zn) concentrations ranged from <1 to 2 µg/L and were below the ANZG (2018) DGV of 8 µg/L for all sites. Filtered zinc concentrations ranged from 2 to 18 µg/L, four of these samples were at or above the DGV (Figure 3-13). The highest zinc concentration was at SG4B.

The filtered and unfiltered arsenic (As) concentrations were above the LoR and were very similar. Samples ranged from 1.6 to 1.9 µg/L, with all recorded concentrations below the ANZG (2018) guideline value of 4.5 µg/L (Figure 3-13).

Filtered and unfiltered lead (Pb) concentrations ranged from <0.1 to 0.4 µg/L (Figure 3-13). Only three unfiltered lead samples were below the LoR (Triplicate C, SG8S and SG1B), while six filtered lead samples were below the LoR (SG12S, Triplicate C, Triplicate D, SG8S, SG4S, SG13B and SG8B). All lead samples

were well below the ANZG (2018) DGV of 4.4 µg/L in slightly to moderately disturbed marine offshore ecosystems, which have a 95% species protection level.

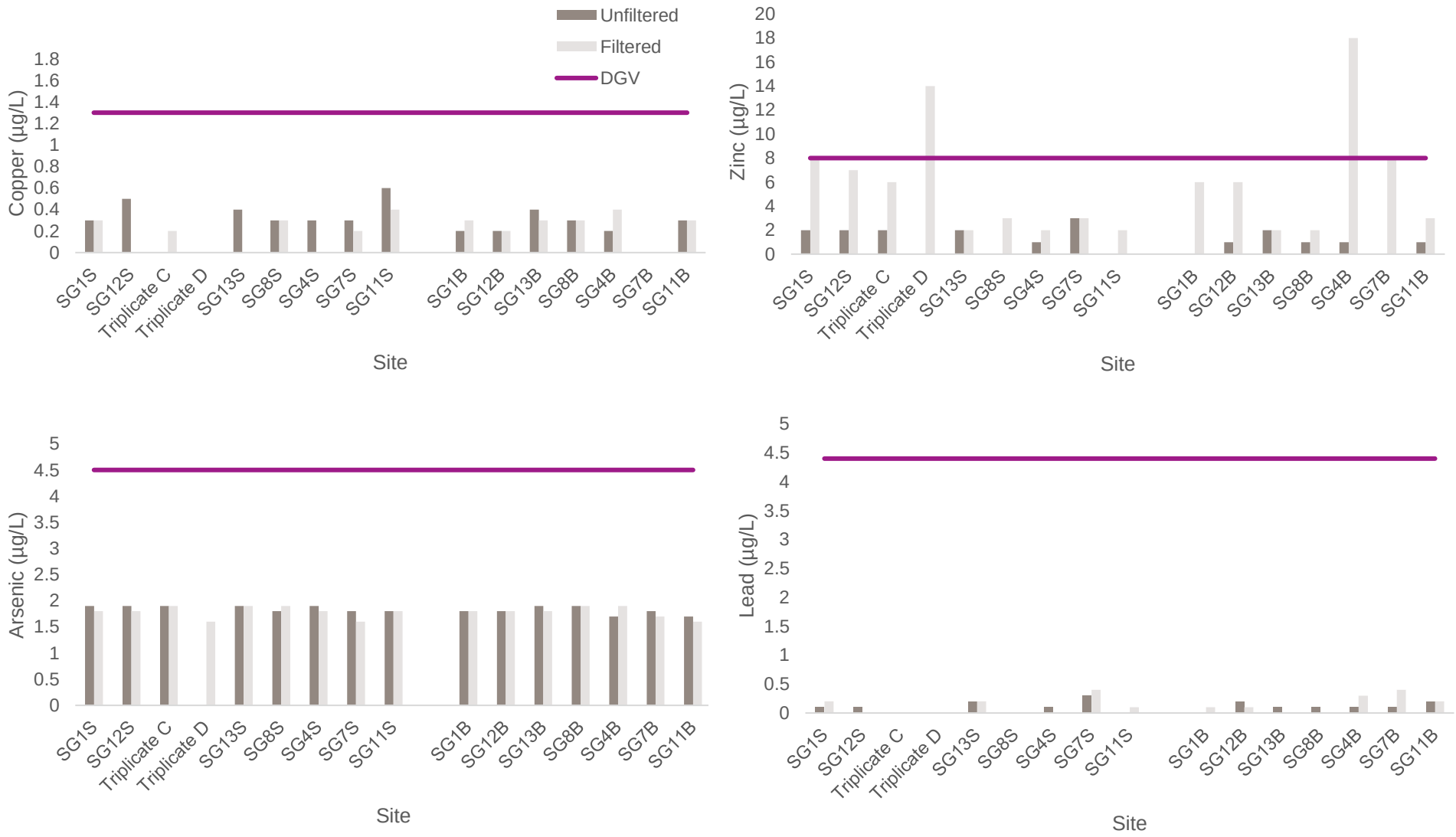


Figure 3-13: Filtered and unfiltered metal concentrations from the Spoil Ground

3.3.2.3 Nutrients and pigments

3.3.2.3.1 Nitrogen

Nitrite and nitrate were only recorded at concentrations above the LoR at two of the Spoil Ground sites, with both being bottom samples. These nitrate concentrations were 12 µg.N/L at SG12B and 4 µg.N/L at SG11B. All surface samples were below the LOR.

Ammonia concentrations were below the LoR for all but three samples. Ammonia was only detected in near-seabed water samples (SG12B, SG4B and SG11B). The Ammonia concentrations in these samples ranged from 3 µg.N/L to 13 µg.N/L. All samples were below the ANZG (2018) default species protection guideline value of 910 µg.N/L for ammonia in slightly to moderately disturbed marine offshore ecosystems, which have a 95% species protection level.

Total nitrogen concentrations indicated the presence of other organic nitrogen compounds, with no samples (excluding the field and transport blanks) being below the LoR of 50 µg.N/L. All but one sample (SG8S) were at or above the ANZG (2018) DGV of 100 µg.N/L total nitrogen in slightly disturbed tropical Australian marine offshore ecosystems.

3.3.2.3.2 Phosphorus

Orthophosphate (filterable reactive phosphorus) concentrations ranged from 4 to 9 µg.P/L. All samples were above the LoR. Eleven samples exceeded the ANZG (2018) DGV of 5 µg.P/L for orthophosphate in slightly disturbed tropical Australian marine offshore ecosystems.

Total phosphorous concentrations ranged from 11 to 16 µg.P/L. All samples exceeded the ANZG (2018) DGV of 10 µg.P/L for total phosphorus in slightly disturbed tropical Australian marine offshore ecosystems.

3.3.2.3.3 Pigments

Chlorophyll-a concentrations ranged from 0.2 to 0.5 µg/L at the Spoil Ground sites. All concentrations were below the ANZG (2018) default guideline value of 9 µg/L for chlorophyll-a in slightly disturbed tropical Australian marine offshore ecosystems. Concentrations were variable across surface and bottom samples.

Phaeophytin-a was also sampled as this pigment is a breakdown product of chlorophyll-a and can be used to indicate if phytoplankton are blooming or declining. Phaeophytin-a was not detected above the LoR for any of the Spoil Ground sites.

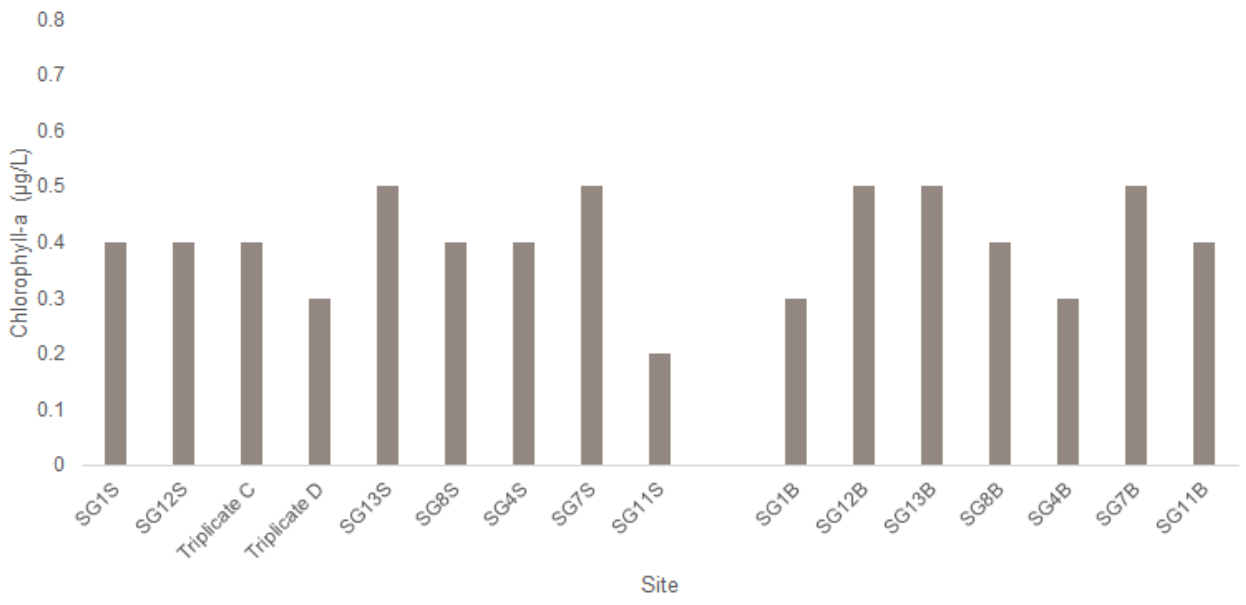


Figure 3-14: Surface and bottom chlorophyll-a concentrations at the Spoil Ground

3.3.2.3.4 Total suspended solids

Total suspended solid (TSS) concentrations were all above the LoR (0.5 mg/L) and ranged from 1.4 to 6.2 mg/L. There was no clear difference found in the TSS between surface and bottom samples.

3.4 Quality control

The hydrocarbon concentrations for both water and sediment samples show no difference between the triplicates and the original sample sites. All blank samples were below the limit of reporting for hydrocarbons.

Appendix E – Protected Matters Search Tool (PMST) Results

Australian Government

Department of Agriculture, Water and the Environment

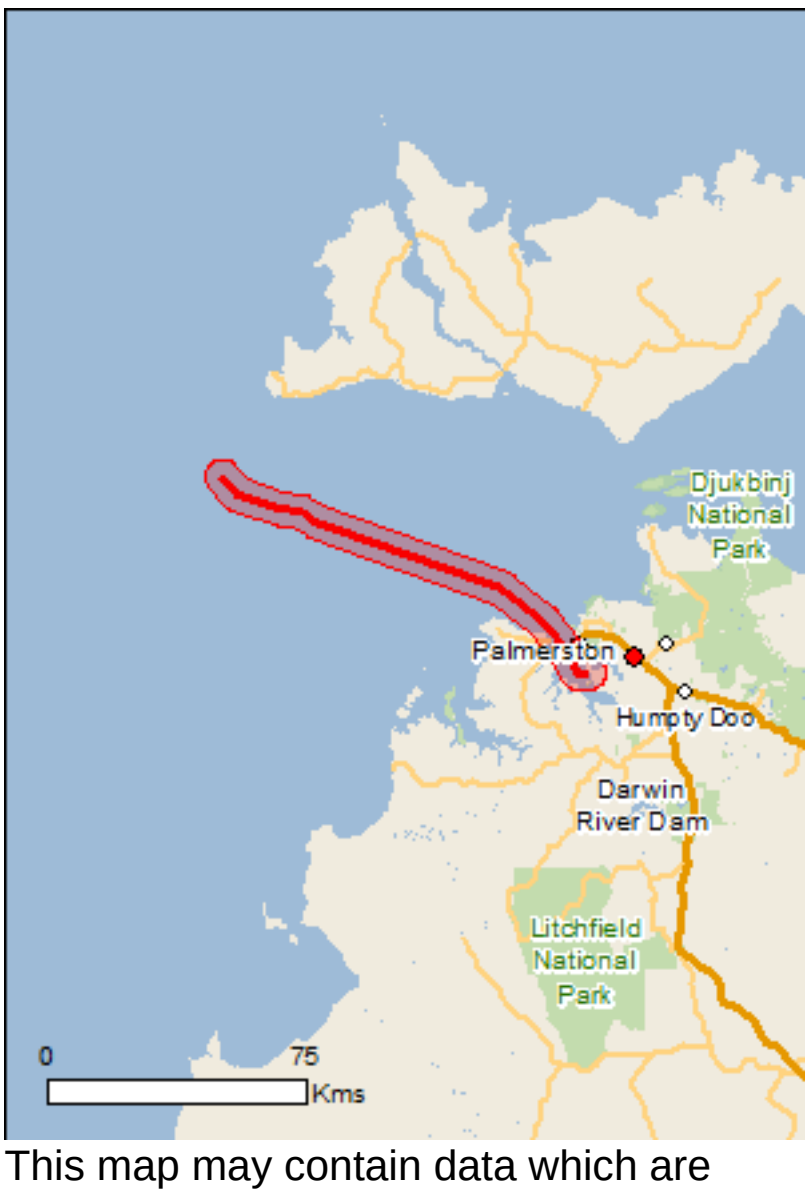
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

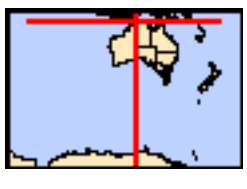
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/10/21 16:43:28



Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	41
Listed Migratory Species:	74

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	9
Commonwealth Heritage Places:	3
Listed Marine Species:	110
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat likely to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur

Name	Threatened	Type of Presence within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		

Name	Threatened	Type of Presence
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Species or species habitat known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Foraging, feeding or related behaviour known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa incana Wandering Tattler [831]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Deputy Crown Solicitor
Defence - AUSTRALIAN ARMY BAND - DARWIN
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE
Defence - Esanda Builidng
Defence - LARRAKEYAH BARRACKS
Defence - Patrol Boat Base (DARWIN NAVAL BASE)
Defence - STOKES HILL OIL FUEL INSTALLATION

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Foraging, feeding or related behaviour known to occur within area
Calidris alba Sanderling [875]		Foraging, feeding or related behaviour known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Foraging, feeding or related behaviour known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius dubius Little Ringed Plover [896]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Foraging, feeding or related behaviour known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Species or species habitat known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Foraging, feeding or related behaviour known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Foraging, feeding or related behaviour known to occur within area
Pluvialis squatarola Grey Plover [865]		Foraging, feeding or related behaviour known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Stiltia isabella Australian Pratincole [818]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Foraging, feeding or related behaviour known to occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Status	Type of Presence
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
George Brown Darwin	NT

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area

Name	Status	Type of Presence
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat may occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant,		Species or species

Name	Status	Type of Presence
ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pennisetum polystachyon		
Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris		
Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Port Darwin	NT

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-12.52496 130.86426,-12.52855 130.84265,-12.51948 130.83031,-12.47611 130.81071,-12.437 130.78192,-12.39655 130.74923,-12.3918 130.74381,-12.31363 130.64517,-12.31029 130.6401,-12.14051 130.15147,-12.11228 130.11083,-12.10622 130.05589,-12.06871 129.94381,-12.02289 129.90689

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix F – NT EPA Pre-referral Screening Tool

NT EPA Pre-referral Screening Tool

The Northern Territory Environmental Protection Authority (NTEPA) has developed a screening tool to assist proponents in determining whether a proposed action requires formal referral (NTEPA, 2021a).

The screening tool is comprised of two parts namely, Part 1 (Screening questions, **Figure 1-1**) to determine whether the referral of the action should be considered further and Part 2 (Checklist) to assess the significance of impact to key environmental factors and requirement to refer the action. Part 1 and Part 2 have been completed below in the context of the Nearshore Barossa Gas Export Pipeline (GEP) Project (hereafter referred to as 'the Project').

1.1 Part 1 – Screening Questions

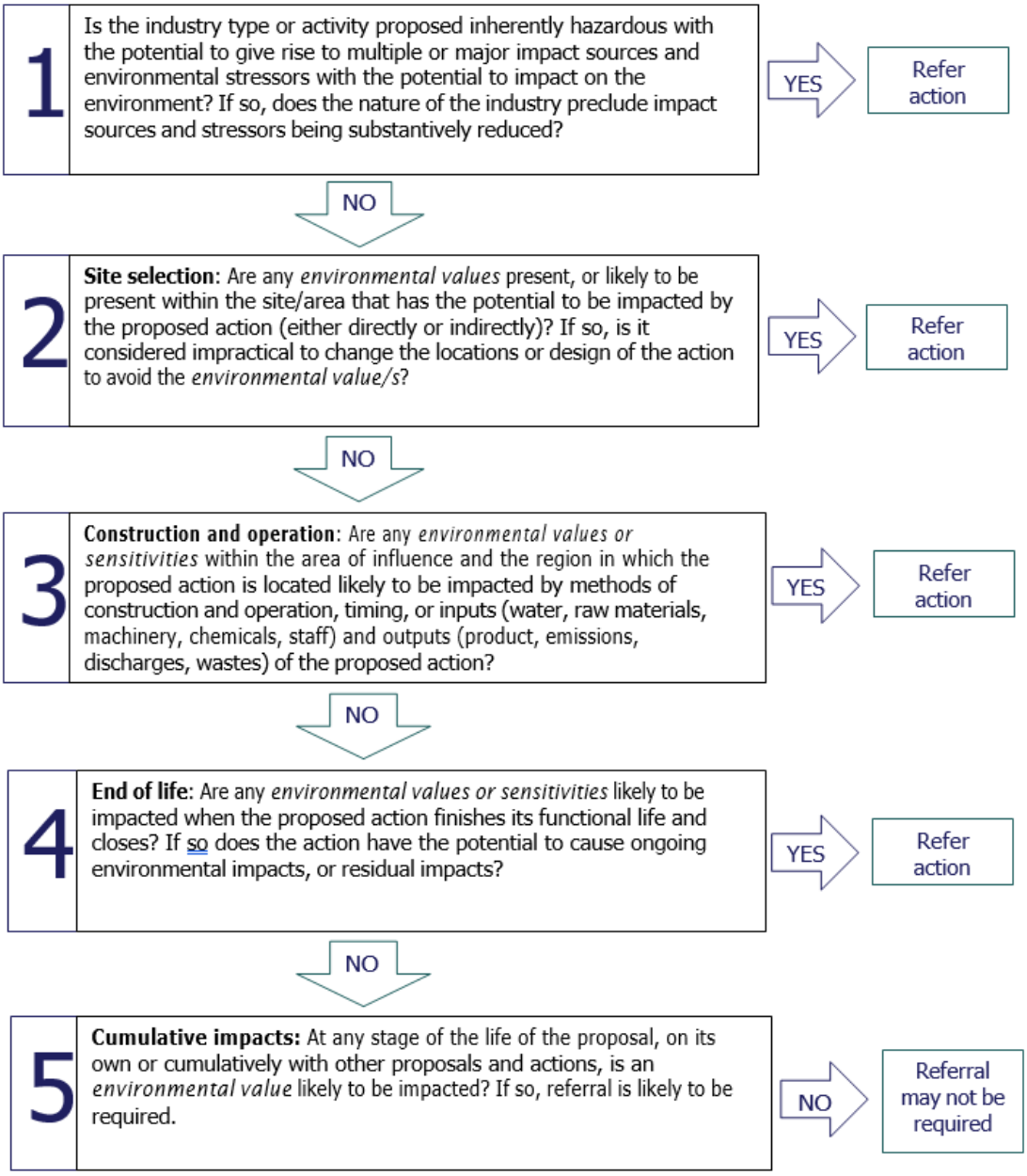

Figure 1-1 NT EPA Pre-referral screening tool Part 1 Screening questions for the Project (NTEPA, 2021a)

1.2 Part 2 – Checklist

Table 1-1 has been adapted from the NTEPA Pre-referral screening tool checklist (NTEPA, 2021a). It provides a preliminary evaluation of whether the Project has the potential to result in a significant impact on the environment and if formal referral to the NTEPA is necessary. **Table 1-1** has been reviewed within the context and framework of the NTEPA's environmental factors and objectives (NTEPA, 2021b).

The scope of the Project in the context of the NT EPA referral includes:

- Installation and operation of a dry gas pipeline (approximately 123 km in length) of which ~100 km is in NT Territorial waters;
- Sediment (borrow) may be required to provide backfill for trenching. This borrow ground will be located in the sand wave region at the mouth of the harbour.
- Spoil that is collected during the trenching activities will be disposed in a location north east of Darwin Harbour.
- Construction of a shore crossing and connection into the existing Darwin LNG facility.

For the purpose of the assessment, the Project Area has been defined to include the extent of all planned activities in the NT, as described in Section 3.5 of the Referral supporting information document, and encompasses activities of seabed preparation, sediment borrow and spoil disposal, installation and operation of the pipeline, onshore activities and support vessel movements in the immediate vicinity of the pipelay vessel (accounting for the full extents of anchor handling).

The Project Area has been sub-divided into three key 'areas' relevant to this referral; being:

- Offshore NT waters (e.g. NT waters outside Darwin Harbour). Note that this includes the proposed location for sediment borrow and spoil disposal;
- Darwin Harbour (e.g. waters within the Darwin Harbour Management Area); and
- Shore crossing location (including the short onshore section of the pipeline).

To undertake a preliminary evaluation of impacts on the NTEPA factors and objectives as a result of the Project, it is important to understand the definition of 'significant impact'. Refer to **Section 1.3** for the definition of a 'significant impact' in relation to the Northern Territory *Environment Protection Act 2019* (EP Act) and the NTEPA's contemporary guidance.

Explanation: *Use questions 1-5 from part 1 of the screening tool. Indicate answer to questions 1-5 in corresponding checkbox. The table below gives an indication of the possible environmental values for each environmental factor that should be considered when considering each question. If the answer to a question is 'yes', it is possible that the proposal may have the potential to have a significant impact on the environment and the proposal should be referred to the NT EPA (NTEPA, 2021a).*

Table 1--1 NTEPA Pre-referral screening tool Part 2 Checklist for the Project (adapted from NTEPA, 2021a)

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the Project	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
LAND	1) Landforms Objective: Conserve the variety and integrity of distinctive physical landforms.	• distinctive features in the landscape, either geological or anthropogenic • subterranean karstic terrain and faults • craters, gorges, ranges, caves, massifs, escarpments, plateaus • monuments • tourism related to landforms	• No key environmental landforms.	N/A	N/A	N/A	N/A	N/A	**Potential impacts are not considered significant.** • No key environmental landforms relevant to the Project for the NTEPA 'Landforms' factor. • There will be no modifications to distinctive physical landforms as a result of the Project. All activities will be undertaken in a linear disturbance footprint, following a pre-disturbed pipeline corridor, mostly in the marine environment. Therefore, this factor is not considered relevant to the Project.
	2) Terrestrial environmental quality Objective: Protect the quality and integrity of land and soils so that environmental values are supportedand maintained.	• good quality soils, including chemical, physical, biological and aesthetic qualities thatsupport life • the biological processes that depend on soil quality	Soils within the Darwin Liquefied Natural Gas (DLNG) facility footprint (inclusive of the shore crossing) are typical of the broader soil types on Wickham Point, which comprise (ConocoPhillips, 2019): • Bedrock consists of meta-sediments that have metamorphosed and undergone one major deformation, producing steep dips and resulting in the pervasive north-north-east strike of the strata; and • Burrell Creek Formation that consists of a sequence of phyllite, siltstone, shale, sandstone and conglomerate.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Direct disturbance to the shoreline at the location of the shore crossing may potentially disturb ecological and hydrological values of the area. However, given the onshore site has previously been disturbed during construction of the DLNG facility, impacts would be minimal. Furthermore, keeping the shore crossing within the existing cleared DLNG footprint avoids impacting an undisturbed site. • Potential for interaction with ASS when trenching within the mangrove muds can lead to water quality effects. Mitigation and management measures in place for

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the Project	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
			There are no known areas of contaminated soils within the DLNG facility (ConocoPhillips, 2019), inclusive of the shore crossing. There is potential for Acid Sulfate Soils (ASS) in the mangrove muds in the vicinity of the shore crossing, as experienced during the initial construction of Darwin LNG.						disposal of acidic muds, including an ASS/PASS Management Plan. If identified, ASS material will be kept submerged, alongside the trench within the existing pipeline disturbance footprint. If this is not possible, ASS will be removed and stored onshore within the DLNG boundary and treated with lime to neutralise acidity. This disposal of spoil will not impact landforms as it will be located below the water line. • Removal of temporary groyne material may lead to localised water quality impacts and ASS disturbance considerations.
	3) Terrestrial ecosystems Objective: Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	• 'sensitive or significant' vegetation or buffers (as defined in the NT Land ClearingGuidelines) • vegetation that provides an important ecological function • listed threatened species and their habitat (NT and Commonwealth) • listed migratory species and their habitat (Commonwealth) • listed threatened ecological communities (Commonwealth) • locally endemic species or species with restricted habitat • species of social, cultural, livelihood and/or economic significance • species that are data deficient and their status is unknown • protected area or reserve, including Indigenous Protected Area • existing conservation and management activities • introduced species and/or invasive species • integrity of terrestrial ecosystems and the ecological services they provide • biological and functional diversity • provision of refuge • food supply	• Minimal flora species, native vegetation or fauna habitats occur within the existing cleared DLNG footprint. The area of the existing shore crossing, within which the Project will occur, was previously cleared, with no requirement for additional disturbance to mangroves outside the current corridor. • Five fauna habitats are known to occur in the wider Wickham Point area (ConocoPhillips, 2019). • Terrestrial fauna and introduced species described at Wickham Point with potential to occur within the DLNG facility and surrounds: 15 mammal species (including two introduced species), 11 species of reptiles, 90 bird species and various frog species (ConocoPhillips, 2019). • An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search completed for the Project (DAWE, 2021) identified approximately; 13 birds, 10 mammals, one reptile and five migratory terrestrial species with potential to occur within a 5 km buffer of the Project area. • Several threatened fauna species listed under the *Territory Parks and Wildlife Conservation Act 2001* (NT) (TPWC Act) with potential to occur within the DLNG facility and surrounds (ConocoPhillips, 2019). • No protected areas or reserves occur within the vicinity of the DLNG facility (ConocoPhillips, 2019). • No nominated, provisional or declared heritage places located within, or directly adjacent to, the DLNG facility site (ConocoPhillips, 2019).	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Onshore area for the Project has previously been cleared during construction of the DLNG facility (inclusive of the shore crossing) in 2003-2004 and unlikely to support habitat for threatened species. This has been verified by site assessments. • The shore crossing alignment is fully within the existing DLNG footprint and disturbance extents will be clearly demarked to prevent impacts beyond agreed boundaries for the Project. • Potential for increase in dust, noise and light emissions during construction with minimal effect on potential fauna within the area. • A Construction Environmental Management Plan (CEMP) will be developed and include controls for introduced species (weeds), dust, noise and artificial light, etc
WATER	1) Hydrological processes Objective: Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	• the supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines • the supply and quantity of water in groundwater features including aquifers, aquitards and water tables • declared beneficial uses • present and future uses, and users of water	• Groundwater monitoring onsite at the DLNG facility and an offsite reference bore, show standing water levels fluctuating between approximately 0.5 m and 4.0 m (ConocoPhillips, 2019). • Higher groundwater water table observed during the wet season compared to the dry season (ConocoPhillips, 2019). • No permanent freshwater habitats on Wickham Point (ConocoPhillips, 2019). • Several small creek lines flow from upland areas of Wickham Point to the harbour during the wet season (ConocoPhillips, 2019). • The waters of Darwin Harbour are declared to	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Onshore area for the Project has previously been disturbed during construction of the DLNG facility. • No permanent surface water features within the DLNG site and surrounds (except on-site water storage, sediment ponds). • There will be no modifications to hydrological processes as a result of the Project. All activities will be undertaken in a linear disturbance footprint, mostly in the marine environment with limited scale and extent. Trenches will be backfilled after construction. There will be no significant changes

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the Project	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
		• current or potential water supplies, including regional scale aquifers • culturally important water features or other features affected by water level	have beneficial uses for the protection of aquatic ecosystems, recreational water quality and aesthetics, under the NT *Water Act*.						to the surfaces and therefore no risk of significantly altering the existing hydrological regime. The likelihood of potential impacts to hydrological regimes of groundwater and surface water in the area is considered to be low and insignificant.
	2) Inland water environmental quality Objective: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	• the quality of water in surface water features including rivers, lakes, wetlands, swamps,creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines • the quality of water in groundwater features including aquifers and water tables • declared beneficial uses • present and future uses and users of water • current or potential water supplies, including regional scale aquifers • potability / drinkability • culturally important water features	• Groundwater pH predominantly acidic (e.g. between 3.8 to 6.7 (ConocoPhillips, 2019). • Groundwater generally low conductivity (ConocoPhillips, 2019). • Heavy metals elevated in groundwater, reflective of the geology of the area (ConocoPhillips, 2019). • No permanent freshwater habitats on Wickham Point (ConocoPhillips, 2019). • Several small creek lines flow only during the wet season from upland areas of Wickham Point to the harbour (ConocoPhillips, 2019). • The natural waterways within the Darwin Harbour region are declared as a beneficial use area.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Onshore area for the Project has previously been disturbed during construction of the DLNG facility. • No permanent surface water features within the DLNG site and surrounds which includes the Project Area. • An ASS management plan will be implemented to prevent water quality impacts. • There will be no impact to inland water environmental quality as a result of the Project. All activities will be undertaken in a linear disturbance footprint, mostly in the marine environment with limited scale and extent. The likelihood of potential impacts to inland water bodies of surface water in the area is considered to be low and insignificant.
	3) Aquatic ecosystems Objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	• threatened species • the health of the biota in inland waterways • the habitats that support the lifecycle of aquatic biota • groundwater dependent ecosystems • Ramsar wetlands • species of social, cultural, livelihood and/or economic significance • integrity of aquatic ecosystems and the ecological services they provide • biological and functional diversity • provision of refuge	• No inland aquatic habitats (i.e. lakes, wetlands, creeks) present within the existing DLNG facility and surrounds. • No groundwater dependent ecosystems present. • No Ramsar wetlands occur within the vicinity of the DLNG facility.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Onshore area for the Project has previously been cleared during construction of the DLNG facility and there are no inland aquatic environments within the boundaries of the DLNG facility. • There are no freshwater aquatic ecosystems (i.e. lakes, rivers) located within or near the Project Area. The mitigation measures would be the same for marine environment quality. This factor is not considered relevant to the Project.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the Project	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
SEA	1) Coastal processes Objective: Protect the geophysicaland hydrological processes that shape coastal morphology so thatthe environmental values of the coast are maintained.	• processes that support marine ecosystems (see Marine Ecosystems Factor below) such as coral reefs, mangroves, salt marshes, seagrass meadows and sponge gardens • primary productivity • nutrient cycling • carbon storage • climate regulation • conservation significant low lying areas including tidal creeks, deltas and river mouths • storm surge protection • unique coastal landforms • cultural and aesthetic values • active or passive recreation	• Nearshore coastal ecosystems in the Darwin Harbour are under the influence of a predominantly macrotidal regime supporting mangroves, intertidal flats and rock platforms.	N/A	Yes	Yes	No	No	**Potential impacts are not considered significant.** • The installation of the pipeline will disturb areas of seabed in Darwin Harbour, the spoil disposal ground, borrow area and the shore crossing during pre-lay works (e.g. trenching, construction of the temporary groyne, spoil disposal and span rectification works) and post-lay works (e.g., trench backfill/rock dump and removal of sand from borrow grounds). • Any spoil removed will be deposited where it will not affect coastal processes. • The Project will not result in a significant change to the existing activities/uses within Darwin Harbour, including coastal processes • Increased sedimentation may result during pipeline trenching/excavation activities which may temporarily influence coastal processes. However, given coastal processes within Darwin Harbour are subject to large tides and strong seasonal influences (wet-season run-off, storms and cyclones) it is considered unlikely that the Project will influence on coastal processes would have significant impact. • Potential impacts will be localised and temporary. Any change to the shore crossing area for the pipeline shore pull activity, will be temporary during pipeline installation and the site will be remediated.
	2) Marine Environmental Quality Objective: Protect the quality and productivity of water, sediment and biota so that environmental valuesare maintained.	• quality of the water, sediment and biota • ecosystem health condition • physical parameters that support fishing and aquaculture • physical parameters that support recreation and aesthetics • industrial water supply • cultural and spiritual values	• Water quality within Darwin Harbour is generally in excellent condition with seasonal and tidal scales providing temporal variation (ConocoPhillips, 2019). • Spatial gradient observed in Darwin Harbour's water quality, with turbidity in the upper reaches higher than that of the outer harbour (ConocoPhillips, 2019). • Large tidal movements and strong currents in Darwin naturally generate high turbidity, particularly during spring tides (ConocoPhillips, 2019). • Water quality parameters remain consistent in the offshore environment (ConocoPhillips, 2020). • Water quality in the Northwest Shelf Transition Province is characterised by low salinity, oligotrophic (low nutrients), influenced by the Indonesian throughflow (ConocoPhillips, 2020).	N/A	Yes	Yes	No	Yes	**Potential for significant impacts** • The Project may lead to temporary and localised increases in turbidity from disturbed sediments during trenching and pipelay activities. Any increases in suspended sediments from pipelay activities and/or sedimentation for both intertidal and subtidal habitats, would be localised and temporary in nature, with the water column rapidly returning to its natural conditions when trenching stops.. Studies of the larger INPEX dredging program in Darwin Harbour demonstrated no measurable environmental impact to seagrass or coral habitats at monitoring sites with the exception of corals at South Shell Island (noting the Project extents to not intersect with this location). INPEX stated that episodic events (tropical storms and cyclones) caused naturally elevated turbidity at much higher intensities over large areas than anything observed from dredging excess alone. Given the pre-lay activities/trenching and level of sediment removal required for the Project is much less than what was required for the INPEX Ichthys Project, it is considered unlikely that the Project would significantly impact on benthic habitats, including seagrass and coral habitats. • Turbidity within the harbour is a natural occurrence as a result of large tidal movements and strong currents, therefore impacts on water quality the

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				Q1	Q2	Q3	Q4	Q5	
									surrounding marine environment are expected to be negligible. • Construction vessels involved in pipelay activities within the shallower waters of Darwin harbour, will require anchoring to the seabed which may result in direct impact to benthic habitats in these locations. • Increase in vessel traffic, including pipelay vessels and construction vessels resulting in increased discharges from vessels (e.g. ballast water, cooling water, sewage etc). Impacts from planned/routine discharges would be highly localised and only result in temporary decreases in water quality within the harbour. • Unplanned discharges/spills from Project vessels (e.g. refuelling etc) may result in short-term decrease in water quality. However, natural tidal flows and regimes within the nearshore environment will allow these discharges to dissipate effectively. • The Project is unlikely to result in a significant long-term change to the existing physical parameters within Darwin Harbour and therefore are unlikely to affect recreation and aesthetic values in the long-term. Temporary amenity issues may be experienced during the construction phase with the increase in vessel traffic and construction equipment within the harbour. • Gas release during operations (e.g. from a pipeline rupture incident) is considered a highly unlikely event and the implementation of a precautionary zone around the pipeline location will minimise the risk of this occurring. Precautionary zones have been implemented for other pipelines within the area and are considered to be successful in minimising impacts from a rupture incident during operations. • A Construction Environmental Management Plan (CEMP) will be developed and include controls for noise and artificial light. • A Trench, Spoil Disposal Management and Monitoring Plan (TSDMMP) will be developed to include controls for trenching and related activities based on water quality monitoring data. • An ASSMP will be developed for the shore crossing activities. • A Waste Discharge Licence (WDL) will be applied for to manage planned discharges to the spoil disposal ground.

	3) Marine ecosystems
	
	<u>Objective:</u> Protect marine habitats to maintain environmental
		• conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat
		• conservation significant marine and coastal benthos, flora and vegetation (seagrass meadows, sponge gardens, coral reefs,
			Conservation significant fauna known to occur within the Project Area include:
			• Marine turtles:
			  • Flatback Turtle – Biologically Important Area (BIA) internesting and habitats critical to the survival of the species intersect the Project Area
			  • Olive Ridley Turtle – BIA internesting and
				N/A	Yes	Yes	No	Yes	**Potential for significant impacts**
									
									• Trenching activities may impact on marine animals such as turtles, inshore dolphins and dugongs, by temporarily altering their behaviour and avoiding the area during works.
									• Construction activities such as trenching may temporarily cause avoidance of turtles, dolphins and fish known to

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	values including biodiversity, ecological integrity and ecological functioning.	mangrove communities and salt marshes)
		• groups of species (species richness and assemblages of species)
		• ecological functions and processes
		• species of social, cultural, livelihood and/or economic significance.
		• integrity of marine ecosystems and the ecological services they supply
		• biological diversity
		• functional diversity
		• provision of refuge
		• food supply
			habitats critical to the survival of the species occur nearby to the Project Area around the Tiwi Islands.
			• Dugongs
			  • There are no Dugong BIAs within or nearby to the Project however, Dugongs are known to frequent inshore waters along the NT coast.
			  • Dugongs are also present in Darwin Harbour (e.g. around Weed Reef). During the Ichthys EIS assessment process, there was concern from stakeholders around impacts that underwater noise and trenching could have on Dugongs at Casuarina Beach and Fannie Bay.
			• Inshore dolphins:
			  • The Project Area intersects BIA's for the Australian Snubfin Dolphin, Indo-Pacific Humpback Dolphin and the Indo-Pacific/Spotted Bottlenose Dolphin, known to undergo breeding, calving and/or foraging within Darwin Harbour.
			• Shorebirds and seabirds:
			  • 13 threatened migratory bird species have the potential to occur within the Project Area.
			• The INPEX Ichthys Project identified no critical habitat or aggregation areas for fish within the offshore area
			• Mangrove habitats utilised for fish breeding are extensive and widespread throughout Darwin Harbour.
			• Darwin Harbour is recognised as a NT Site of Conservation Significance supporting a range of estuarine, freshwater and terrestrial environments of ecological values, including extensive areas of intertidal mudflats rock platforms and a diverse area of mangroves. The rocky shore communities support a range of marine flora and fauna, including oysters, limpets, barnacles, chitons, sponges, crustaceans, hard and soft corals and various algae/macroalgae species (INPEX, 2010).
			• The Port Darwin wetlands (NT029 Port Darwin) are listed as a Nationally Important Wetland under the Directory of Important Wetlands in Australia, located on the inner shores of Darwin Harbour.
			• The Project area intersects the Charles Point Reef Protection Area (RPA) and is relatively close proximity to the Lorna Shoal RPA (approximately 9 km to the east). The protection of these areas is to prevent over-fishing of golden snapper, black jewfish and other vulnerable reef species.
			• Benthic habitat within Darwin Harbour predominantly comprises of macroalgae and filter feeders.
			• Use of mud whelks for indigenous food.
									occur in the area with potential impacts on behaviour.
									• Underwater noise and light emissions generally have the potential to impact marine fauna, given Project vessels will not add significantly to the existing vessel traffic, vessel-based activities, or lighting in Darwin Harbour and beyond, impacts on marine ecosystems beyond temporary behavioural changes (e.g. avoidance of Project activities) are unlikely.
									• Whale migration tends to occur further offshore within Commonwealth waters and is therefore unlikely to be adversely impacted by the Project.
									• Light emissions generated by vessels and other construction activities may present a potential risk to marine fauna (i.e. birds, turtles, sharks/rays and other fish) causing a temporary change in movement patterns and/or behaviour.
									• Potential for vessel collision with marine fauna such as turtles, inshore dolphins and dugongs, however, given the large number of vessels already utilising Darwin Harbour regularly, the increase in vessel traffic from the Project is considered unlikely to result in a greater risk of vessel collision with marine fauna.
									• Fish may be attracted to areas disturbed by trenching to feed upon invertebrates liberated from the seafloor sediments and there may be an increase in feeding and predation. It is unlikely that mortality would occur from physical clogging of their gills by turbid plumes as this type of impact is generally only evident with very high suspended sediment concentrations (e.g. 400 mg/L), which would be very rare for the Project, as per the Ichthys assessment.
									• There is also potential for fish deaths caused by water acidity from localised impacts of acid sulfate leachates in the marine environment. Areas of potential ASS should be monitored prior to and during trenching activities to avoid water acidity impacts.
									• Pre-lay trenching within shallower waters in Darwin Harbour may result in displacement and smothering of benthic organisms and habitats during pipelay activities. Although the Project follows the existing Bayu-Undan to Darwin pipeline and avoids sensitive benthic habitats, further assessment should be undertaken to qualify the extent of impacts once the construction methodology is confirmed.
									• Areas where pipeline is to be laid on the seabed will result in localised disturbance of a narrow corridor.
									• Pipeline shore crossing to be trenched and backfilled with rock and excavated material up to ground level requiring removal of a small area of mudflat and potential mangrove habitat. A vegetation survey of the shore crossing disturbance area confirmed the presence of only one species of mangrove in proximity to the proposed alignment, *Sonneratia alba*, of which there were only a handful of individuals (e.g. less than 5 plants within 20 m either side). This species of mangrove (*S. alba)* is a common taxon that is well represented and characterised as part of the mangrove monitoring programme at DLNG. It is considered unlikely that the small amount of habitat

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				Q1	Q2	Q3	Q4	Q5	
									disturbed would result in long-term effects to the ecological function of the mangrove community. • Trenching in the nearshore environment of Darwin Harbour will result in disturbance to the Port Darwin Wetlands. However, as described above, a vegetation survey of the shore crossing location has confirmed that the vegetation within proximity to the proposed alignment are typically of low-value (excepting *S. alba*), and well represented in the area. Where mangrove species exist, these are in very low numbers within the corridor, and any disturbance to these individuals would be limited in extent and determined to not have any significant impact to the broader environmental values at a community or population level. • Spoil disposal ground for trenched material located north of Darwin Harbour and opposite the Ichthys spoil ground. • Rock armoured pipeline will provide artificial reef habitat. • Planned and unplanned discharges associated with construction activities may impact on marine ecosystems.
AIR	1) Air quality Objective: Protect air quality and minimise emissions and their impactso that environmental values are maintained.	• the chemical, physical and biological characteristics of quality air • the biological processes that depend on the air quality	• There are no permanent sources of air pollution in the offshore environment and air quality is likely to be excellent. • The nearshore environment within Darwin Harbour is within the Darwin regional airshed, with contributing influences from vehicles, industrial point sources, shipping and biogenic sources. In particular, regional air quality is influenced seasonally from bushfires.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Air emissions from vessels (e.g. engines and generators) in the offshore environment are likely to dissipate rapidly, with no measurable impact on the ambient offshore air quality. • Air emissions from vessels in the nearshore environment will be localised and temporary (during construction) • Given the nature of Darwin Harbour as an extensive shipping channel/Port, it is expected that Wickham Point, and the areas surrounding Darwin Port, would experience changes in the local air quality influenced by the number of vessels transiting through the area. The Project will result in a temporary increase in shipping traffic, however appropriate engagement and planning with the relevant authorities will avoid significant impacts. • Generation of dust associated with construction of the shore crossing, however, given the site has already been cleared, impacts are likely to be limited to trenching works. Appropriate dust control measures are considered to be effective in mitigating potential impacts. • Potential for release of air emissions from commissioning activities (e.g. dry natural gas release from pipeline). • With the application of appropriate mitigation measures, the Project impacts and risks are manageable such that environmental values are supported and maintained.
	2) Atmospheric processes Objective: Minimise greenhouse gas emissions so as to	• a contribution to the NT's greenhouse gas emissions • adaptation to a changing climate • capacity of communities and country to respond or adapt to climate change	• Emissions from the Project will be minimal in a local scale greenhouse emissions context.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Increase in greenhouse gas emissions associated with Project vessels are likely to be minimal, however given the pipeline installation activities may take up to 15 months within NT waters, this may contribute to a cumulative increase in GHG

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	contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.								emissions to be considered. • Noting that NT regulators are focusing on industry within Darwin Harbour and associated GHG emissions. • GHG emissions associated with the project will be managed under existing legislative regimes and environmental approvals (e.g., DLNG life extension approvals). • With the application of appropriate mitigation measures, the Project impacts and risks are manageable such that environmental values are supported and maintained.

PEOPLE	1) Community and economy
	
	Objective: Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.
		• dwellings, homelands, communities, towns and suburbs where people live
		• liveable environment
		  ○ good amenity – air quality, noise, aesthetics
		  ○ access to natural resources including bush food
		  ○ recreational use of the natural or built environment (e.g. fishing, cycling, sports, picnics)
		  ○ access to social infrastructure and services including transport and logistics
		• Healthy lifestyles
		  ○ sense of wellbeing
		  ○ good mental health
		  ○ community aspirations
		• Financial security
		  ○ affordable access to food, water, electricity, transport and communication networks
		  ○ livelihoods
		• participation in jobs, businesses and education
		• existing industries such as agriculture, pastoralism, tourism, fisheries
		• vulnerable sectors of the community
		• connections to culture and community (that are not explicitly protected under cultureand heritage legislation addressed in the Culture and heritage factor)
		  ○ Aboriginal rights and interests, including right of access
		  ○ cultural practices
		  ○ sense of belonging, inclusion, connectedness and cohesion
		  ○ healthy social relationships
			• One Commonwealth fisheries overlaps the location of the Project namely, Northern Prawn Fishery.
			• Three NT fisheries overlap the Project Area namely, Spanish Mackerel, Coastal Line Fishery and Demersal Fishery.
			• Darwin Harbour is utilised for commercial shipping, recreational boating and fishing, tourism and naval activities (ConocoPhillips, 2019).
				N/A	No	No	No	No	**Potential impacts are not considered significant.**
									
									• The Project will require the provision of local goods and services throughout the construction period resulting in employment opportunities and economic benefits for the NT.
									• The Project will not propose a significant change to the existing activities/uses within the offshore and nearshore marine environments (including in Darwin Harbour) and are unlikely to result in a long-term adverse impact on the local community and economy.
									• Temporary increase in vessels during construction activities (i.e. pipelay vessels, rock dump vessels, supply vessels and general construction vessels), including anchored vessels within shallow waters within the harbour and dynamically positioned vessels for deeper waters.
									• The Project may require temporary access restriction to fishing sites during construction (i.e. around vessels and pipeline), however these activities will be localised and will not prohibit fishing activities nearby. No different to previous pipeline construction projects in Darwin Harbour.
									• A precautionary zone may be required around the pipeline within the Northern Prawn Fishery to avoid damage to fishing equipment and the pipeline. This area would be small in relation to the area available to the fishery and unlikely to result in a significant impact, especially given the DPD pipeline is only ~100 m from the existing BU-Darwin pipeline
									• Trenching may cause increased sedimentation within the harbour waters, adversely affecting the water quality and productivity of fishing activities. These impacts would be temporary and localised to a narrow corridor surrounding the pipeline.
									• Potential for increased fishing opportunity in the long-term through provision of artificial reef.
									• Increased pressures on local goods and services to accommodate construction workforce, however this would be temporary and ongoing consultation with the local community will assist in managing potential impacts.
									• Temporary increase in traffic, including heavy

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									haulage for machinery and equipment, sourcing of rock from quarry for rock-placement Rock quarrying, transport and ship loading to be managed by third parties using approved facilities and in accordance with local road transport regulations.
	2) Culture and heritage Objective: Protect sacred sites, culture and heritage.	• sacred sites • historic heritage and places • world heritage	• Wickham Point is considered to be of cultural significance to the Larrakia people. • Aboriginal people may have been buried on Wickham Point in the past, however the existing DLNG facility is well away from potential burial sites. A significant program, of heritage site identification, classification, and protection / removal was undertaken for the DLNG facility, and the proposed Project will remain within the previously surveyed and cleared envelope. Therefore, the potential to encounter previously unidentified heritage sites is very low. • No registered or recorded sacred sites within the DLNG site. • Adjacent marine areas have been used as a historical source of food. • Wickham Point and other areas surrounding Darwin Harbour have significant European heritage values. • INPEX EIS identified Indigenous Sacred Sites near and north of Weed Reef A number of shipwrecks considered to be associated with World War II are located within Darwin Harbour. • One shipwreck nearby to the Project area that is protected under the Commonwealth *Underwater Cultural Heritage Act 2018* namely, the Japanese submarine I-124, sunk in 1942.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • The onshore DLNG facility was surveyed prior to the construction of the facility to identify heritage values. There are no Aboriginal sites of significance within the shore crossing. • The location of shipwrecks within Darwin Harbour and surrounds is well understood. The Project may result in temporary access restrictions to diving sites during construction. However, these are short-term activities and should only temporarily affect recreational diving. • The potential for long term adverse effects to shipwrecks is considered unlikely, given the route alignment is to avoid known shipwrecks. • Disturbance of UXO's is unlikely as specialist site surveys have been undertaken.

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				Q1	Q2	Q3	Q4	Q5	
	3) Human health Objective: Protect the health of the Northern Territory population.	• drinking water • recreational water • air quality • bush tucker • radiological limits • biting insects	• The existing DLNG facility is not within a Public Drinking Water Area. • Fishing tourism is important to the NT's economy and there are several fishing clubs who utilise Darwin Harbour (ConocoPhillips, 2019). • The nearshore environment within Darwin Harbour experiences extensive shipping traffic. • Biting insects are prevalent on a seasonal and diurnal basis in and around the mangrove fringe of Wickham Point and surrounds.	N/A	No	No	No	No	**Potential impacts are not considered significant.** • Given the onshore location of the Project being within an industrialised area, it is considered unlikely that significant impacts would occur to human health from this component of the Project. • Darwin Harbour is utilised as a fishing area but given the extensive use of the harbour for commercial shipping activities, the Project works are not expected to cause a significant long-term change to the existing activities/uses of the harbour and are therefore unlikely to impact on human health. • The activities arising from the Project are within the existing cleared DLNG pipeline corridor. Impacts are deemed to be insignificant, and not expected to give rise to human health effects, and further assessment is not required. • Amenity impacts arising from air quality (dust), noise and light are addressed in Air Quality, demonstrated to be localised and temporary in nature.

1.3 Definition of 'Significant Impact'

The Northern Territory *Environment Protection Act 2019* (EP Act) defines a significant impact as:

"A significant impact of an action is an impact of major consequence having regard to:
(a) the context and intensity of the impact; and
(b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact".

The NT EPA guidance on referral of a proposal (NTEPA, 2021a) outlines how the NT EPA determines that environmental impact assessment of a proposal is not required. The NT EPA will consider the proposal in terms of its potential for significant environmental impacts. In its consideration, the NT EPA will examine:

- context and intensity of the impact
- duration, magnitude and geographic extent of the impact and
- sensitivity, value and quality of the environment impacted on.

Environmental impact assessment is unlikely to be required where:

- the type of proposal is not considered hazardous in nature
- environmental impacts from activities associated with a proposal are readily understood
- the potential impacts are limited in extent and duration
- environmental values and sensitivities are not present or are unlikely to be significantly impacted by proposed activities
- impact mitigation is readily available and proven to be effective in limiting significant impacts to the environment, and
- the referral demonstrates that relevant stakeholders have been identified and engaged, and documents the outcomes of the engagement, in accordance with the NT EPA's guidance on stakeholder engagement and consultation.

1.4 References

ConocoPhillips, 2019. *Darwin LNG Transition Work Program Notice of Intent*. ConocoPhillips. Perth, Western Australia.

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Department of Agriculture, Water and Environment (DAWE), 2021. *Protected Matters Search Tool (PMST) Report*. Available from: Protected Matters Search Tool: Interactive Map (environment.gov.au) (accessed 19/05/2021).

Department of the Environment and Energy (DoEE), 2017. *Recovery Plan for Marine Turtles in Australia*. Australian Government, Canberra, Australian Capital Territory.

Northern Territory Environment Protection Authority (NTEPA), 2021a. *Referring a Proposal to the NT EPA: Environmental impact assessment, Guidance for proponents (version 1.0)*. Darwin, Northern Territory, Australia.

Northern Territory Environment Protection Authority (NTEPA), 2021b. *NT EPA Environmental Factors and Objectives: Environmental impact assessment General Technical Guidance (version 2.0)*. Darwin, Northern Territory, Australia.

Appendix G – Assessment of EPA Factors - Not Significant Factors and Objectives

Element	Description
Terrestrial Environmental Quality	
NT EPA Factor and Objective	+ Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
Policy and guidance	+ Land Clearing Guideline (DENR, 2019); + Preparation of an Environmental Management Plan (NT EPA, 2015); + Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2021b); + Identification and Investigation of Acid Sulphate Soils (ASS) and Acidic Landscapes (DER, 2015a); + Treatment and Management of Soils and Water in Acid Sulphate Soil Landscapes (DER, 2015b); + DLNG Exceptional Development Permit; + Waste Management and Pollution Control Act 1998 (NT); + Water Act 1992 (NT); + Soil Conservation and Land Utilisation Act (NT); and + DLNG Environment Protection Licence conditions.
Potential Impacts	<u>Construction</u> + Erosion and sedimentation; – Pre-lay works (including trenching of the shore crossing and onshore pipeline area) and shore pull activities, will create temporary disturbance to land and soils increasing the risk of soil erosion and sedimentation of downstream environments such as the nearby mangrove community by wind / surface water runoff. + ASS; – Pre-lay works including trenching (particularly at the shore crossing location) and disturbance by machinery and rock placement in the intertidal zone, has the potential to disturb Acid Sulphate Soils (ASS) and/or Potential Acid Sulphate Soils (PASS) within the mangrove muds. If acid Sulphate soil is exposed and oxidised, it may cause acid leachate to form leading to mobilisation of heavy metals and run-off of contamination into nearby soils. URS conducted an ASS Investigation for the DLNG Project in 2002 concluding the presence of ASS material within the mangrove muds that underlay tidal flats and mangrove communities along the shoreline of Wickham Point (Phillips Petroleum Company, 2002). + Rock placement; – Rock will be used to construct a temporary groyne. When removed, there is potential for contamination of soils from marine sediments at the final disposal / re-use location. + Chemical spills; – Onshore construction including, shore crossing and shore-pull activities, may result in minor hydrocarbon and chemical spills to land. It is expected that potential impacts can be managed through the implementation of standard management measures including use of spill kits and spill response equipment. <u>Operation</u> + No impact from disturbance or release to land or soils is expected during the operation phase. The risk of soil erosion and sedimentation is low. The risk from ASS during the operational phase of the Project is considered to be negligible, as further exposure of ASS is not expected to occur.
Environmental Management and Mitigation	+ Erosion and sedimentation; – Disturbance from pre-lay works and shore pull activities will be within the existing DLNG facility disturbance envelope and will be temporary, relatively localised and linear in nature. It is considered that impacts can be managed through the application of standard management measures, including the environmental management plans committed to by Santos. – A Construction Environmental Management Plan (CEMP) will be developed including measures for erosion and sediment control, spill and waste (including materials used for temporary groyne construction) management. + ASS; – A geotechnical survey will be undertaken prior to construction and include assessment of ASS to the depth of disturbance. – A specific ASS Management Plan will be developed and implemented, including contingency measures such as: 1. if identified, ASS material will be kept submerged, alongside the trench within the existing pipeline disturbance footprint. If this is not possible, ASS will be removed and stored onshore within the DLNG boundary and treated with lime.

Element	Description
	2. ASS material may be used as backfill after treatment onsite with lime. If it is not geotechnically suitable for re-use, it will be removed from site for other re-use or disposal; or disposed of offshore at the spoil disposal ground. + Rock Placement; – If material from the temporary groyne cannot be re-used within the Project boundary, off-site disposal will require consideration and management of impacts from marine sediments. + Chemical Spills; – Spill kits and spill response equipment (sorbents, booms, skimmers, clean-up equipment etc.) to be maintained during construction to enable a timely response to limit exposure area and period. – Hazardous chemicals to be stored in bunded areas, which shall be to be frequently inspected and maintained.
Potential Cumulative Impact Summary	+ Erosion and sedimentation; – Cumulative impacts are not expected. + ASS; – Cumulative impacts are not expected. + Rock Placement; – Cumulative impacts are not expected. + Chemical Spills; – Cumulative impacts are not expected.
Conclusions and Forward Management	+ The Project has the potential to affect soil or land quality during the construction period, though impacts will be small, temporary, localised and linear in nature. + Disturbance and trenching onshore will be within the existing DLNG facility disturbance area. Impacts will be managed through the application of mitigation measures and monitoring. + Further detailed investigations (in particular the potential for interaction with ASS/PASS) prior to disturbance will be undertaken to support the development of site-specific management plans. + It is concluded that impacts on Terrestrial Environmental Quality are manageable, such that the NT EPA objective for this factor is able to be met with a high degree of certainty.
Terrestrial Ecosystems	
NT EPA Factor and Objective	+ Protect the NT's flora and fauna so that environmental values including biological diversity, ecological integrity ecological functioning are supported and maintained.
Policy and guidance	+ Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA 2013a); + NT EPA Environmental Factors and objectives: Environmental impact assessment general technical guidance (NT EPA 2021a); + Matters of National Environmental Significance, Significant impact guideline 1.1 (DoE 2013); + Land clearing guidelines (DEPWS 2021); + Weeds Management Act 2001 (NT); + Waste Management and Pollution Control Act 1998 (NT); + Water Act 1992 (NT); + Energy Pipelines Act 1981 (NT); and + Light Pollution: Effects of Wildlife (DAWE, 2021).
Assessment of Potential Impacts	<u>Construction</u> + Native Flora and Fauna; – Pre-lay works (including trenching of the shore crossing and onshore pipeline area) and shore pull activities, may result in the minor direct loss of flora and/or vegetation re-growth (including fauna habitat). Indirect disturbance or degradation to surrounding flora and vegetation from erosion, dust, disturbance of ASS and chemical/hydrocarbon spills may also occur. Impacts are expected to be low and insignificant given the pre-existing context of the DLNG operational facility at Wickham Point. – The onshore portion of the Project will be located within the existing shoreline crossing and corridor that connects into Darwin LNG, which was subject to prior assessment and approval within the existing DLNG disturbance envelope. Therefore, the pre-selection of the proposed pipeline alignment, to co-align with the existing Bayu-Undan to Darwin pipeline corridor, inherently minimises disturbance to terrestrial ecosystems (including flora, vegetation and fauna) and is unlikely to change the existing biological diversity and ecological integrity of terrestrial ecosystems. In addition, no threatened or protected species reside within the onshore disturbance area. A targeted vegetation survey of the shore crossing disturbance area conducted on 17 November 21, confirmed the presence of only one species of mangrove in proximity to the proposed alignment, *Sonneratia alba*, of which there were only a small number of individuals (e.g. less than 5) within 20 m either side of the alignment. *S. alba* is a common taxon that is well represented and characterised as part of the mangrove monitoring programme at DLNG. Other vegetation within the Project area was confirmed to be of low ecological value.

Element	Description
	– Onshore construction including increased personnel presence and vehicle movements during construction, may result in indirect impacts, such as disturbance to fauna resulting in avoidance of the area. Impacts are expected to be low and insignificant given the pre-existing context of the DLNG operational facility at Wickham Point. – Pre-lay works (including trenching of the shore crossing and onshore pipeline area) has the potential to increase the risk of bushfire; however as a major hazard facility fire risk is carefully managed with existing and substantive controls in place to protect the facility. + Introduction or Spread of Invasive Species; – Onshore construction including, shore crossing and shore-pull activities has the potential introduce species (e.g. weeds, ants, cane toads – noting these are present within the DLNG facility and broader surrounds). + Fauna Behaviour Change – elevated noise and light from background conditions, such as from the use of machinery and vehicles have the potential to result in avoidance of the site by animals. Given the location within the existing DLNG disturbance envelope and the surrounding industrialised use of the Port area, local impacts are likely to be negligible and are unlikely to result in detrimental impacts to fauna nearby. Potential impacts will be localised and temporary and will not result in long-term impacts. In addition, Migratory birds do not utilise the onshore disturbance area in any significant way and are expected to avoid the area during construction activities. <u>Operation</u> + No disturbance to terrestrial ecosystems is expected during the operation phase given the location within the existing DLNG disturbance footprint and the existing industries utilising the Darwin Harbour shorelines. Impacts are expected to be low and insignificant given the pre-existing context of the DLNG operational facility at Wickham Point.
Environmental Management and Mitigation	+ Native Flora and Fauna; – A Construction Environmental Management Plan (CEMP) will be developed and include controls for land clearing. – Access restrictions outside Project Area to reduce potential for accidental clearing and unauthorised disturbance. – Vehicle movement and speed restrictions to minimise the potential for dust to adversely impact vegetation and reduces impact to fauna species. – Implementation and compliance with the existing DLNG Emergency Response Plan for bushfires. + Introduction or Spread of Invasive Species; – A Construction Environmental Management Plan (CEMP) will be developed and include controls for introduced species (weeds, insects, fauna). + Fauna Behaviour Change – A Construction Environmental Management Plan (CEMP) will be developed and include controls for dust, noise and artificial light.
Potential Cumulative Impact Summary	+ Native Flora and Fauna; – Given the location of the onshore components of the Project within the existing DLNG disturbance envelope, cumulative impacts to terrestrial ecosystems are not expected. + Introduction or Spread of Invasive Species; – Cumulative impacts are not expected. + Fauna Behaviour Change – As above, cumulative impacts are not expected.
Conclusions and Forward Management	+ The proposed onshore Project activities will result in the direct but minor loss of some flora and vegetation (predominantly re-growth), however this will be minor and inconsequential. There is limited potential for direct disturbance (injury or mortality) to fauna from the onshore activities and/or collisions with vehicles or equipment. Given these activities will be within the existing DLNG facility disturbance area and the application of approved mitigation and management measures, it is concluded that impacts on Terrestrial Ecosystems are manageable, such that the NT EPA objective for this factor is able to be met with a high degree of certainty.
Air Quality	
NT EPA Factor and Objective	+ Protect air quality and minimise emissions and their impact so that environmental values are maintained.
Policy and guidance	+ Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2021b); + Ambient Air Quality National Environment Protection Measure (NEPM); + NT EPA Draft Guideline Recommended Land Use Separation Distances (NT EPA, 2017); + DLNG Environment Protection Licence conditions; + Noise Guidelines for Development Sites in the Northern Territory (NTEPA 2014); and + Exceptional Development Permit.

Element	Description
Assessment of Potential Impacts	<u>Construction</u> + Air (Dust); – The project activities, as relevant to this factor of Air Quality (dust) have limited potential for off-site effects. The pipeline shore crossing and corridor into DLNG are within the existing industrial area, and there are no residential receptors in proximity to the facility. The nearest major residential populations in proximity to the DLNG facility include Palmerston to the north-east of Middle Arm Peninsula (approximately 10 km by direct line of sight from the DLNG site), and the Darwin central business district (approximately 6 km by direct line of sight from the DLNG site). – Onshore construction activities such as use of machinery and vehicles movements, along with trenching, stockpiling and reinstatement works can result in a minor reduction in local air quality. Exposure to dust/particulate matter is also a potential human health risk dependent on exposure, volumes and the receiver's health. This will be very localised, temporary, and highly unlikely to give rise to off-site effects. – Operation of construction equipment and vehicles will generate exhaust particulates. This will result in a localised reduction of air quality in the immediate area of the source. It is anticipated this will be of negligible impact. + Noise; – The proposed project activities will have limited off-site effects from noise. The shore crossing and corridor into DLNG are within the existing industrial area, and there are no residential receptors in proximity to the facility. The nearest major residential populations in proximity to the DLNG facility include Palmerston to the north-east of Middle Arm Peninsula (approximately 10 km by direct line of sight from the DLNG site), and the Darwin central business district (approximately 6 km by direct line of sight from the DLNG site). – Previous noise modelling studies undertaken at the existing DLNG site (Bechtel, 2001 and ConocoPhillips, 2019), indicated that typical minimum noise levels at commercial/residential areas (e.g. Darwin city, East Arm, Durack, Palmerston) ranged between 34.2 decibels A-weighted (dB (A)) and 41.0 dB (A). The construction activities associated with the Project will be smaller in scale and nature compared to the construction of DLNG and potential noise impacts are unlikely at residential receptors. – Operation of construction equipment and vehicles will generate local noise. This will result in a reduction of amenity in the immediate area of the source. It is anticipated this will be of negligible impact considering the industrial and relatively remote location. + Light; – The proposed project activities will have limited off-site effects from light. The shore crossing and corridor into DLNG are within the existing industrial area, and there are no residential receptors in proximity to the facility. The nearest major residential populations in proximity to the DLNG facility include Palmerston to the north-east of Middle Arm Peninsula (approximately 10 km by direct line of sight from the DLNG facility), and the Darwin central business district (approximately 6 km by direct line of sight from the DLNG site). – It is expected that majority of activities will be undertaken during daylight hours, for safety and logistical reasons. Construction and installation activities during the night will require additional lighting, both on land and over water from vessels. – Onshore construction activities including use of machinery and vehicles emitting artificial light may contribute incrementally to the existing light conditions observable by night, temporarily. Increased lighting could result in temporary disruption to wildlife behaviour or amenity impacts. Given that the area does not provide suitable nesting habitat for turtles, is infrequently used by shorebirds, it is unlikely that any species will be adversely affected by lighting during construction of the pipeline and shore crossing, given the short-term temporary nature. – Continuous lighting is provided at the DLNG facility, Ichthys LNG facility and Darwin Port. Therefore it is considered that any lighting generated during short-term construction of the Project will be comparable with the surrounding nearshore and land uses and activities currently operational in the area, for a significantly shorter duration. <u>Operation</u> + No impact to air, noise or light is anticipated above existing approved levels for DLNG during operations.
Environmental Management and Mitigation	+ A Construction Environmental Management Plan (CEMP) will be developed and include controls for dust, noise and light management.
Potential Cumulative Impact Summary	<u>Air (Dust)</u> + Onshore construction activities such as use of machinery and vehicles movements may result in an incremental reduction in local air quality due to the emission of dust. Given the nature of the activities, and the predominance of other sources (including bushfires on a seasonal basis) that influence local and regional air quality, the contribution of the short-term project activities to cumulative air quality will be negligible. <u>Noise and light</u> + Onshore construction including the presence of machinery and increased personnel may result in an incremental reduction in local amenity. Given the nature of the activities, the contribution of the short-term project activities to cumulative noise and light will be negligible.
Conclusions and Forward Management	+ The nature of the Project activities have limited potential to result in significant off-site effects. The shore crossing and connection into DLNG are within the approved corridor for the existing DLNG facility, with no nearby residential receptors, and the nature of the activities will be short-term, localised and temporary. The application of measures to control air quality and noise and light amenity issues are standard and well-established. The environmental objective for Air Quality is to protect air quality and minimise emissions and their impact so that environmental and amenity values are maintained. With the application of appropriate mitigation measures, it is concluded that the project impacts and risks are manageable such that existing environmental values are supported and maintained.

Element	Description
Atmospheric Processes	
NT EPA Factor and Objective	+ Minimise greenhouse gas (GHG) emissions so as to contribute to the NT Government's aspirational target of achieving net zero greenhouse gas emissions by 2050.
Policy and guidance	+ Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2021b); + National Greenhouse and Energy Reporting Act 2007 (NGER Act); + National Greenhouse and Energy Reporting Regulations (NGER Regulation) 2008; + National Greenhouse Accounts Factors: 2021 (DISER 2021a); + State and Territory Greenhouse Gas Inventories 2018 (DISER 2020); + Northern Territory Climate Change Response: Towards 2050 (NTG 2020); + Greenhouse Gas Emissions Management for New and Expanding Large Emitters (DEPWS 2021d); + MARPOL Annex VI; and + DLNG Environment Protection Licence conditions.
Assessment of Potential Impacts	<u>Construction</u> + Construction-related greenhouse gas (GHG) emissions will be predominantly associated with vessel, vehicle, equipment and helicopter hydrocarbon (e.g., diesel) combustion. Such emissions will be relatively small, temporary and short in duration (i.e. ~15 months). Santos and its contractors will continue to operate in accordance with respective climate change / carbon reduction polices and strategies in order to meet company emission reduction targets. <u>Operation</u> + This referral is based on the premise that the Project operational phase will not alter GHG emissions beyond those already approved for DLNG. The DPD Project will convey natural gas from Barossa to DLNG facility. The environmental approvals described in Appendix B provide for this supply of natural gas and extended DLNG operations to approximately 2050. The extended DLNG operations will be managed in accordance with the Australian Government Safeguard Mechanism, which places a cap (baseline) on DLNG facility GHG emissions. Given GHG emissions will be regulated as part of the DLNG facility, they are not considered to be a key factor for this referral.
Environmental Management and Mitigation	+ Equipment and machinery will be appropriately maintained to minimise air emissions. + Monitoring and reporting of fuel consumption, and calculated GHG emissions, during Project activities to meet legislative requirements and ESG reporting requirements. + Optimise construction activities and transport logistics to minimise fuel consumption. + Pursuant to MARPOL Annex VI, vessels to maintain a current International Air Pollution Prevention Certificate, as relevant to vessel class, which certifies that measures to prevent air emissions are in place.
Potential Cumulative Impact Summary	+ The GHG emissions relevant to the construction phase of the Project will incrementally contribute to the NT and Australian GHG carbon budget. However, given the short-term nature of construction activities the incremental increase in GHG emissions will be temporary and minor in a domestic and national context.
Conclusions and Forward Management	+ The assessment is based on the premise that the Project represents a duplicate pipeline to convey gas from Barossa to DLNG, to be processed within the existing licenced operational capacity. Project construction activities will be an insignificant GHG contributor to the NT and Australian carbon budget; hence, there will be no significant impact to the NT or Australian environment. As such, the NT EPA objective for this factor is able to be met with a high degree of certainty.
Community and Economy	
NT EPA Factor and Objective	+ Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.
Policy and guidance	+ Environmental Impact Assessment and Environmental Approval in the Northern Territory: Environmental Impact Assessment Guidance (NT EPA, 2021b); + Darwin Harbour Regional Management Strategic Framework 2009 – 2013 (draft), DHAC; + Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013); + Marine Act 1981 (NT); + Control of Roads Act 1953 (NT); + Traffic Act 2987 (NT); and + Ports Management Act.

Element	Description
Assessment of Potential Impacts	<u>Construction</u> + Socio-Economic: – Employment and economic opportunities locally, regionally and nationally: the Project may increase employment opportunities within the local community during the construction period. – The Project will not present a significant change to the existing activities/uses within the offshore and nearshore marine environments (including in Darwin Harbour) and is unlikely to result in long-term adverse impacts on the local community and economy. – Increased pressures on local goods and services: from accommodation of construction workforce, however this would be temporary and ongoing consultation with the local community will assist in managing potential impacts. – Direct and indirect impacts to recreational and commercial areas and industries including Darwin Harbour: increase in competition for port resources with other users and visual impact of project-related activities during construction. – Damage to commercial fishing equipment or catch from construction activities, vessel movements or hydrocarbon spill. – Reduction in number and quality of fish species targeted by fishers from hydrocarbon spill: along with temporarily displacing fishers from the area, however displacement would likely be localised and short term. – Reduction in mud crab numbers and quality from increased turbidity: The outcomes of a study for Ichthys concluded that potential impacts to mud crabs were low residual risk with the exception of one impact on migration of adult and juvenile mud crabs which was identified as medium risk (SKM, 2011). Given the extent of dredging associated with the Ichthys project (e.g. 16.9 Mm^3 of dredge spoil) compared to the Project (maximum of 750,000 m^3) potential impacts to mud crabs are expected to be low and insignificant. – Reduced water quality and productivity of fishing activities: Potential impacts will be temporary and localised to a narrow corridor surrounding the pipeline. Trenching and disposal of trench spoil at the spoil disposal ground has potential to create localised and temporary sedimentation effects. Monitoring for Ichthys (INPEX Browse, 2010) demonstrated elevated turbidity attenuated to background levels within 5 km from the source at the spoil disposal ground (adjacent the spoil disposal ground for the Project), and within ~ 8 km of the dredge source in East Arm with dispersion greater during spring tides (stronger currents) and during the dry season. Potential impacts are expected to be low and insignificant. – There may be some temporary exclusions to fishing and recreational zones as the vessels move along the Project pipeline route and some recreational users may be deterred from using parts of Darwin Harbour. The environmental monitoring undertaken as part of the Ichthys project, interviewed recreational fishers to determine the level of impact the projects exclusion zones had on their activities. It was concluded that only small-scale spatial shifts in fishing effort were recorded during dredging surveys, but these were accompanied by slight increases in other areas around Darwin Harbour. Given the Ichthys Project's dredging campaign was significantly larger than the pipeline trenching proposed for the Project, any impact to access and aesthetics of fishing and recreational areas would be much lower. + Traffic and Access: – There will be a temporary increase in vessels during construction activities (e.g. pipelay vessels, rock placement vessels, supply vessels and general construction vessels), including anchored vessels within shallow waters within the harbour and dynamically positioned vessels for deeper waters. – There is potential for local traffic increase during the construction phase. – Temporary reduction in access to recreational fishing areas during construction (e.g. around vessels and pipeline, and spoil disposal ground), however these activities will be localised and will not prohibit fishing activities nearby. There is potential for increased fishing opportunity in the long-term through provision of artificial reef. – Temporary reduction in access to recreational marine activities owing to reduced visibility in turbid waters. – Temporary reduction in of access to traditional fishing and foraging grounds due to vessel activity or spill. – Temporary disruptions to commercial vessel activities with Darwin Port. <u>Operation</u> + Operational activities are not expected to adversely impact the community or economy. The implementation of pipeline precautionary zones is unlikely to significantly impact recreational and commercial activities, other than the inconvenience of not being able to anchor within the narrow precautionary zone.
Environmental Management and Mitigation	+ Socio-Economic; – A Trench, Spoil Disposal Management and Monitoring Plan (TSDMMP) and Waste Discharge Licence (WDL) will be developed to include controls for trenching and related activities based on water quality monitoring data. – Stakeholder engagement plan to continue through Project planning and execution. – Dedicated stakeholder engagement liaison. + Traffic and Access; – Standard maritime communications equipment, navigation lights and markers on Project vessels. – Standard maritime notices will be issued to other marine users as required. – Implement a precautionary zone (marine) around Project activities.

Element	Description
	– Ongoing stakeholder engagement (e.g. Darwin Port, representative fishing bodies, etc.) to minimise third-party vessel interactions and impacts to other marine users (e.g. commercial shipping, recreational and commercial fishers, etc.). – The proposed pipeline route will be marked on marine charts, in the same way that the existing pipelines are gazetted and marked on marine charts.
Potential Cumulative Impact Summary	+ The Project is a pipeline duplication, that follows the pre-existing Bayu-Undan to Darwin pipeline and connecting into DLNG to support continuing operations; hence, cumulative impacts are expected to be minimal.
Conclusions and Forward Management	+ Project activities are compatible with the pre-existing marine and land uses of the area, following an existing pipeline corridor and within an area zoned for industrial purposes. The Project will provide a duplicate pipeline, to convey gas into the existing DLNG facility to support operations within existing approved capacity. The construction and operational Project phases will provide continued and substantive economic benefits to Darwin and the NT economy. + Santos considers potential impacts to the Community and Economy to be readily manageable, such that the NT EPA objective for this factor is able to be met with a high degree of certainty.
Culture and Heritage	
NT EPA Factor and Objective	+ Protect sacred sites, culture and heritage.
Policy and guidance	+ Heritage Act 2011 and Regulations 2012; and + Northern Territory Aboriginal Sacred Sites Act 1989 and Regulations 2004.
Assessment of Potential Impacts	<u>Construction</u> + The existing DLNG facility disturbance envelope has previously been surveyed prior to the construction of the facility to identify cultural and heritage values; hence, no values will be impacted. + Santos has been proactively engaging with AAPA, as well as traditional land owners. Through consultation with the APPA as part of pre-referral engagement, it has been confirmed that an AAPA Certificate for the entire Project Area is required. Santos is in the process of preparing an application to AAPA, at the time of this referral. + The location of shipwrecks within Darwin Harbour and surrounds is well understood and the proposed pipeline route and spoil disposal grounds avoid known shipwrecks. <u>Operation</u> + Operational activities are unlikely to impact cultural or heritage values as described above for construction activities.
Environmental Management and Mitigation	+ Stakeholder engagement plan to continue through Project planning and execution. + Dedicated stakeholder engagement liaison. + Project activities within the DLNG disturbance envelope will be managed in accordance with existing land access agreements with traditional owners. + The proposed pipeline route avoids identified Aboriginal sacred sites, as well as known European heritage sites such as shipwrecks. + Santos will obtain a Authority Certificate from AAPA prior to the commence of pre-lay construction works. + Mooring procedure will be developed to allow safe anchoring of vessels undertaking pipelay, trenching and related marine activities in the vicinity of known cultural or heritage sites of significance.
Potential Cumulative Impact Summary	+ The Project will avoid identified cultural and heritage sites of significance, honour existing land access agreements, and obtain all necessary development permits/certificates; hence cumulative impacts to cultural and heritage values are not expected.
Conclusions and Forward Management	+ Project activities are compatible with the pre-existing marine and land uses of the area, following an existing pipeline corridor and within an area zoned for industrial purposes. The cultural and heritage values within the Project Area are considered to be well understood, as are the associated regulatory/ management requirements (i.e. AAPA certification). Santos will continue to implement the Project Stakeholder Engagement Plan (SEP) to ensure this remains the case. Hence, Santos considers that potential impacts to Culture and Heritage are readily manageable, such that the NT EPA objective for this factor is able to be met with a high degree of certainty.

Appendix H – Threatened and Migratory Species – Likelihood of Occurrence Assessment

For the purposes of an NT EPA referral a high-level desktop assessment was undertaken to determine the likelihood of the species listed in the PMST would be to occur within the Project Area. This process has been adopted by multiple consultants over multiple projects in the Northern Territory. The process was adopted based on likelihood assessments undertaken in the Darwin Harbour during previous infrastructure projects being the Darwin Ship Lift Facility and Marine Industries Project and the Ichthys Project, as per the following:

- KBR (2018), Kellogg, Brown & Root Pty Ltd (KBR), 2018, Darwin Ship Lift Facility and Marine Industries Project –Notice of Intent, prepared for Northern Ship Support Pty Ltd
- AECOM (2021), AECOM 2021 Draft Environmental Impact Statement. Darwin Ship Lift prepared for Department of Chief Minister and Cabinet.
- Acer Vaughan Consulting Engineers and Consulting Environmental Engineers 1993, Draft Environmental Impact Statement, Darwin Port Expansion – East Arm, Prepared for the Northern Territory Department of Transport & Works, Darwin, Northern Territory.
- INPEX 2010, Ichthys Gas Field Development Project: Draft Environmental Impact Statement, INPEX Browse, Ltd.
- URS 2002, Darwin 10 MTPA LNG facility: public environmental report, Report prepared by URS Australia Pty Ltd for Phillips Petroleum Company Australia Pty Ltd, Darwin, Northern Territory.

Threatened and Migratory Species – Likelihood of Occurrence Assessment

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Reptiles					
Flatback Turtle	*Natator depressus*	VU/M	VU/M	Flatback Turtles frequent the waters of Darwin Harbour but the lack of sandy beaches within the Harbour inhibits nesting activity.	**Likely** - No important habitat (foraging or nesting) for the species occurs within the Project Area. Individuals are likely to be sighted transiting through the area as they move through foraging areas.
Green Turtle	*Chelonia mydas*	Not listed	VU/M	Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with driftlines and rafts of Sargassum (a floating marine plant that is also carried by currents). Once Green Turtles reach 30 to 40 cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. In Australia, there are seven regional populations of green turtles that nest in different areas; the southern Great Barrier Reef, the northern Great Barrier Reef, the Coral Sea, the Gulf of Carpentaria, Western Australia's north-west shelf, the Ashmore and Cartier Reefs and Scott Reef.	**Unlikely** - No suitable habitat (foraging or nesting) for the species occurs within the Project Area. The species is not known from the Darwin Harbour area.
Hawksbill Turtle	*Eretmochelys imbricata*	VU	VU/M	Post-hatchling turtles spend several years in the pelagic environment often in association with rafts of Sargassum. Once Hawksbill Turtles reach 30-40 cm curved carapace length, they enter benthic foraging habitat on coral and rocky reefs habitat in tropical and subtropical waters (sometimes temperate waters) where they will remain for decades. Two major breeding areas occur in Australia: Northern Great Barrier Reef and on the North-West Shelf of WA.	**Unlikely** - No suitable habitat (foraging or nesting) for the species occurs within the Project Area. The species is not known from the Darwin Harbour area.
Leatherback Turtle	*Dermochelys coriacea*	CE	EN/M	Occurs in all coastal waters of Australia, with most sightings in temperate waters. Most of the nesting in Australia appears to be low density and there are no major nest sites recorded in Australia. Although nesting is mostly confined to tropical beaches, there are records of nests in northern NSW.	**Unlikely** - No suitable habitat (foraging or nesting) for the species occurs within the Project Area. The species is not known from the Darwin Harbour area.
Loggerhead Turtle	*Careta Caretta*	VU	EN/M	Occurs in tropical and warm temperate waters off the Australian coast. This species chooses a wide variety of tidal and sub-tidal habitat as feeding areas. The female comes ashore to lay her eggs in a hole dug on open, sandy beaches. In Australia there are two unique breeding populations: Eastern (Mon Repos, Wreck Rock, Wreck Island) and Western (Muiron Islands, Ningaloo Coast south to about Carnarvon and islands near Shark Bay).	**Unlikely** - No suitable habitat (foraging or nesting) for the species occurs within the Project Area. The species is not known from the Darwin Harbour area.
Olive Ridley Turtle	*Lepidochelys olivacea*	EN/M	EN/M	Nests in sandy beaches and resides in coastal zones along the northern coast of Australia. Mostly forages in shallow benthic habitats and also in pelagic foraging habitats. There are four major nesting areas in Australia: East coast from Mon Repos in the south to Herald Island in the north, North-Eastern Gulf of Carpentaria and western Torres Strait (the largest), western NT, and in the Kimberly and Pilbara regions of WA.	**Likely** - No important habitat (foraging or nesting) for the species occurs within the Project Area. Individuals are likely to be sighted transiting through the area as they move through foraging areas.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Plains Death Adder	*Acanthophsis hawkei*	VU	VU	Prefers flat, treeless, cracking soil riverine floodplains	**Unlikely** – Whilst the species has been recorded within 5km of the preferred route alignment for the Project Area, there is no suitable habitat within the Project Area
Yellow-spotted monitor*	*Varanus panoptes*	Not listed	VU	This species has been recorded across most of the Top End and the Gulf Region in a variety of habitats, including coastal	**Unlikely** – The species has been recorded within 5km of the preferred route alignment for the Project Area. The species may use suitable habitat in the project area from time to time. There will be a lack of suitable habitat during the dry season when all of the waterways in the area are completely dry.
Mammals					
Bare-rumped Sheath-tailed Bat	*Saccolaimus saccolaimus*	VU	Not listed	Open Pandanus woodland fringing the and eucalypt tall open forests. It roosts in tree hollows and caves.	**Unlikely** - no suitable habitat within the Project Area, given the onshore/shore crossing location is within the existing DLNG disturbance envelope.
Black-footed Tree-rat	*Mesembriomys gouldii*	EN	VU	Occurs in the Top End of the NT in tropical woodlands and open forests in coastal areas.	**Unlikely** - no suitable habitat within the Project Area, given the onshore/shore crossing location is within the existing DLNG disturbance envelope.
Blue Whale	*Balaenoptera musculus*	Not listed	EN/M	The blue whale is found in every ocean except the arctic, with a range that extends from the periphery of drift-ice in polar seas to the tropics. It follows seasonal migration pattern between summering and wintering areas although some individuals may remain in certain areas year-round. They mate and calve in tropical-to-temperate waters during winter months and feed in polar waters during summer months.	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean. It is seen to occur further offshore within Commonwealth waters.
Brush-tailed Rabbit-rat	*Conilurus penicillatus*	VU	EN	The preferred habitat is eucalypt tall open forest, has been known to also occur on coastal grasslands with scattered large *Casuarina equisetifolia* trees, beaches, and stunted eucalypt woodlands on stony slopes. It shelters in tree hollows, hollow logs and, less frequently, in the crowns of pandanus or sand palms.	**Unlikely** – Suitable habitat may be available; however, this species appears to be restricted to the Coburg Peninsula and some islands.
Fawn Antechinus	*Antechinus bellus*	VU	EN	Occurs in savannah woodland and tall open forest of the Top End of the NT, shelters in tree hollows and fallen logs, shows a preference for areas exposed to cooler and less frequent fires.	**Unlikely** - no suitable habitat within the Project Area, given the onshore/shore crossing location is within the existing DLNG disturbance envelope.
Fin Whale	*Balaenoptera physalus*	Not listed	VU/M	The North Atlantic fin whale has an extensive distribution, occurring from the Gulf of Mexico and Mediterranean Sea, northward to Baffin Bay and Spitsbergen. In general, fin whales are more common north of approximately 30°N latitude, but considerable confusion arises about their occurrence south of 30°N latitude because of the difficulty in distinguishing fin whales from Bryde's whales.	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean. It is seen to occur further offshore within Commonwealth waters.
Ghost Bat	*Macroderma gigas*	VU	Not listed	The distribution of this species is influenced by the availability of suitable caves and mines for roost sites. Daytime roosts may change seasonally. One of the largest known colonies occurs in a series of gold mine workings at Pine Creek in the Northern Territory.	**Unlikely** - no suitable habitat within the Project Area, given the onshore/shore crossing location is within the existing DLNG disturbance envelope.
Humpback Whale	*Megaptera novaeangliae*	Not listed	VU/M	Occurs in oceanic and coastal waters around the world. Australia has two distinct Humpback Whale populations which throughout all coastal waters surrounding Australia; east coast and west coast. Camden sound appears to be the northern most limit for the majority of the west coast whales and is considered to be an important breeding area. The migratory habitat for the humpback whale around mainland Australia is primarily coastal waters less than 200m in depth and generally within 20km of the coast .	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean. It is seen to occur further offshore within Commonwealth waters.
Nabarlek (Top End)	*Petrogale concinna*	EN	VU	Nabarleks are restricted to rocky areas, especially on steep slopes, with large boulders, caves and crevices. They may move from these to forage in adjacent flat areas.	**Unlikely** - no suitable habitat within the Project Area
Northern Brush-tailed Possum	*Trichosurus vulpecula arnhemensis*	Not listed	VU	Most records are from tall open forests dominated by *Eucalyptus miniata and E. tetrodonta.*	**Unlikely** – the species is unlikely to be present in light of recent reductions in range
Northern Quoll	*Dasyurus hallucatus*	EN	CE	This species formerly occurred across much of northern Australia, from south-eastern Queensland to the south-west Kimberley, with a disjunct population in the Pilbara. The most suitable habitats appear to be rocky areas.	**Unlikely** – whilst the species has historically been recorded within 5km of the Project Area the species is unlikely to be present in light of recent reductions in range

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Sei Whale	*Balaenoptera borealis*	Not listed	VU/M	Sei whales have been infrequently recorded in Australian waters. Typically occur within deeper offshore waters.	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean.
Water Mouse / False Water Rat	*Xeromys myoides*	VU	Not listed	Mangrove forests, freshwater swamps and floodplain saline grasslands.	**Unlikely** – the species has not been recorded within 5km of the Project Area and there is no suitable habitat on the leases.
Birds					
Australian Painted Snipe	*Rostratula australis*	VU	VU	Shallow, vegetated, freshwater swamps, claypans or inundated grassland	**Unlikely** – No suitable habitat within the Project Area
Curlew Sandpiper	*Calidris ferruginea*	CE	VU	Fresh and brackish water, can include ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Eastern Curlew	*Numenius madagascariensis*	CE	VU/M	They are most common in mangrove areas but will also forage on intertidal flats and saltmarshes.	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Gouldian Finch	*Erythrura gouldiae*	EN	VU	The species forages in open woodland with groundcover of *Sorghum* and other annual and perennial grasses. Nests in hollows in *Eucalyptus tintinnans.*	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Great Knot	*Calidris tenuirostris*	CR	VU/M	Migratory species. In the NT birds settle on large sheltered intertidal mudflats and sandflats, especially in mangrove areas.	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Greater Sand Plover	*Charadrius leschenaultii*	VU	VU/M	In the NT, Greater Sand Plovers have been recorded from most of the coastline. In the NT they forage along sandy beaches and sheltered mudflats and have been reported them occasionally also using inland saline wetlands but always close to the coast.	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Grey Falcon	*Falco hypoleucos*	VU	VU	Occurs in lightly timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm.	**Unlikely** – Has not been recorded within 5km of the project area and suitable habitat does not occur within the Project Area.
Lesser Sand Plover	*Charadrius mongolus*	EN	VU/M	Migratory species. In the NT the birds forage on sheltered mudflats, sandy beaches, estuaries and mangroves. They have also been reported to use inland saline wetlands occasionally but always close to the coast.	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Masked Owl (mainland Top End)	*Tyto novaehollandiae kimberli*	VU	VU	Occurs mainly in eucalypt tall open forests (especially those dominated by Darwin woollybutt *Eucalyptus miniata* and Darwin stringybark E. *tetrodonta*), but also roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands. Although it may roost in dense foliage, it more typically roosts, and nests, in tree hollows.	**Unlikely** - no suitable habitat within the Project Area
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	VU	VU	Widespread in coastal areas such as wetlands, however predominantly found in New Zealand during breeding season.	**Unlikely** - no suitable habitat within the Project Area
Partridge Pigeon	*Geophaps smithii*	VU	VU	Occurs in open forest and woodland dominated by *Eucalyptus tetrodonta* and *E. miniata* with a structurally diverse understorey.	**Unlikely** - no suitable habitat within the Project Area
Red Gosshawk	*Erythrotriorchis radiatus*	VU	VU	Forest and woodland with a mosaic of vegetation types, including eucalypt woodland, open forest, gallery rainforest, swamp sclerophyll forest and rainforest margins.	**Unlikely** - no suitable habitat within the Project Area
Red Knot	*Calidris canutus*	EN	VU/M	Migratory species. In the NT birds settle on large sheltered intertidal mudflats and sandflats and are rarely encountered far from the coast.	**Unlikely** – Whilst the species has been recorded within 5km of the Project Area, there is no suitable habitat within the Project Area
Sharks					
Dwarf Sawfish	*Pristis clavata*	VU	VU/M	The species' Australian distribution is considered to extend north from Cairns around the Cape York Peninsula in QLD, across northern Australian waters to the Pilbara coast in Western Australia. The species usually inhabits shallow (2–3 m) coastal waters and estuarine habitats. The species does not utilise any purely freshwater areas, as its range is restricted to brackish and salt water.	**Unlikely** - Individuals of this species have been recorded in the Darwin Harbour Region. The Project Area does not contain key habitat resources for this species for foraging or breeding. Individuals of this species may occur in the Project Area as it searches for suitable foraging areas. The closest known record is over 10 km from the Project Area.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Freshwater Sawfish	*Pristis pristis*	VU	VU/M	The freshwater Sawfish may potentially occur in all large rivers of northern Australia from the Fitzroy River, WA, to the western side of Cape York Peninsula, QLD. The name Freshwater Sawfish is a misnomer. It is a marine/estuarine species that spends its first 3-4 years in freshwater then the larger mature animals tend to occur more often in coastal and offshore waters up to 25 m depth. Freshwater Sawfish occur in fresh or weakly saline. The species tends to move up rivers during flood periods. Small specimens, mostly less than 150 cm, have been caught in remote ponds where they have been isolated for several years between floods.	**Unlikely** - Individuals of this species have been recorded in the Darwin Harbour Region. The Project Area does not contain key habitat resources for this species for foraging or breeding. Individuals of this species may occur in the Project Area as it searches for suitable foraging areas. The closest known record is over 20 km away from the project area.
Great White Shark	*Carcharodon carcharias*	Not Listed	VU/M	In Australia, Great White Sharks have been recorded from central QLD around the south coast to north-west WA but may occur further north on both coasts. It has been sighted in all coastal areas except in the NT. The Great White Shark moves seasonally along the south and east Australian coasts, moving northerly along the coast during autumn and winter and returning to southern Australian waters by early summer. Found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. They also make open ocean excursions and can cross ocean basins (e.g. South Africa to WA). Often found in regions with high prey density	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean and is not typically off the Northern Territory coast.
Green Sawfish	*Pristis zijsron*	VU	VU/M	The Green Sawfish was once widely distributed but it is now thought that northern Australia may be the last region where significant populations of Green Sawfish exist. They inhabit muddy bottom habitats and also enter estuaries where they can be found in shallow water. Its habitat is heavily fished and often subject to pollution, habitat loss and degradation.	**Unlikely** - Individuals of this species have been recorded in the Darwin Harbour Region. The Project Area does not contain key habitat resources for this species such as foraging or breeding. Individuals of this species may occur in the Project area as it searches for suitable foraging areas. The closest known record is over 20 km from the Project Area.
Northern River Shark	*Glyphis garricki*	EN	EN	The species is known only from a small number of locations in WA, NT and PNG. Since its discovery in 1986, only 36 specimens have been recorded. Little is known of the ecology of the northern river shark but it is probably restricted to shallow, brackish reaches of large rivers. This conclusion is based on the fact that it has not yet been caught in the coastal marine areas despite considerable fishing and collecting activity in these habitats. In the NT this species is only known within the from the Adelaide and East and South Alligator River systems	**Unlikely** - While individuals of this species of have been recorded in the broader Darwin area, these records are located well away from the Project Area in different habitat then what is found in the Project Area. This species is not known in the Darwin Harbour area.
Speartooth Shark	*Glyphis glypis*	Not Listed	CE/M	Predominantly occurs within tidal rivers and estuaries within the Northern Territory.	**Potential** – Potential to occur within Darwin Harbour.
Whale Shark	*Rhincodon typus*	Not Listed	VU/M	In Australia, the Whale Shark is known from NSW, QLD, NT, WA and occasionally VIC and Southern Australia, but is most commonly seen in waters off northern WA, NT and QLD. The Whale Shark seasonally aggregates in coastal waters off Ningaloo Reef between March and July each year, at Christmas Island between December and January, and in the Coral Sea between November and December. The Whale Shark is an oceanic and coastal, tropical to warm-temperate pelagic hark.	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean.
Migratory Marine Birds					
Common Noddy, Brown Noddy	*Anous stolidus*	Not Listed	M	Tropical seabird with worldwide distribution. They breed on tropical and subtropical inshore or oceanic islands, which have rocky cliffs and coral or sand beaches. It nests on the ground, in trees or shrubs, and on cliffs or man-made structures, such as docks and jetties. During the non-breeding season, they will spend most of its time at sea and may roost on water, rocks, islets, flotsam and even the backs of sea turtles.	**Unlikely** - The project area does not contain suitable habitat for the species, given it is located within the existing DLNG facility disturbance envelope and the species may only be seen transiting the area, but is unlikely to land onshore with no suitable foraging habitat present.
Fork-tailed swift	*Apus pacificus*	Not Listed	M	They spend most of the year relatively high in the air column, only coming down to near ground level at times of bad weather. Seen over open country from semi deserts to coasts, islands and sometimes over forests and cities.	**Unlikely** - Species is aerial and unlikely to be found within the Project Area but may be observed as an overhead visitor.
Great Frigatebird, Great Frigatebird	*Fregata minor*	Not Listed	M	It is a widespread seabird, with major colonies in the Indian Ocean, West and Central Pacific and Southern Atlantic. They inhabit remote islands in tropical and sub-tropical seas, where it breeds in small bushes, mangroves and even on the ground.	**Unlikely** - Limited suitable habitat is present in the Project Area. The species has not been recorded in the Darwin region in the last 30 years

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Lesser Frigatebird, Least Frigatebird	*Fregata ariel*	Not Listed	M	It is a widespread seabird, with major colonies in the Indian Ocean, West and Central Pacific and Southern Atlantic. They inhabit remote islands in tropical and sub-tropical seas, where it breeds in small bushes, mangroves and even on the ground. Outside the breeding season it is sedentary, with immature and non-breeding individuals dispersing throughout tropical seas.	**Unlikely** - Limited suitable habitat is present in the Project Area. The species has not been recorded in the Darwin region in the last 15 years.
Little Tern	*Sternula albifrons*	Not Listed	M	Inhabits coastal waters, bays, inlets, saline or brackish lakes, salt fields and sewage ponds near coast throughout northwest, north, east and southeast Australia. It can also be found further inland, sometimes up to several kilometres from the sea.	**Unlikely** - Limited suitable habitat is present in the Project Area. The species has not been recorded in the Darwin region in the last 15 years.
Streaked Shearwater	*Calonectris leucomelas*	Not Listed	M	This species is pelagic and abundant off the north coasts of Australia from November to May. Occurs -on the west and east coasts in summer. Species is abundant off northern Australian coasts.	**Unlikely** - The project area does not contain suitable habitat for the species.
Migratory Marine Species					
Australian Snubfin Dolphin	*Orcaella heinsohni*	Not Listed	M	They occur in inshore coastal areas and some rivers from eastern India to north-eastern Australia and through southeast Asia to Vietnam. Inhabits coastal, brackish and freshwaters of the tropical and subtropical Indo-Pacific. A substantial population was located in the western Gulf of Carpentaria, and another in Blue Mud Bay. The species lives in brackish waters near coasts, river mouths and in estuaries.	**Likely** - Suitable habitat for the species is present. Individuals of the species have previously been recorded near Catalina Island, located to the east on the Project Area.
Bryde's Whale	*Balaenoptera edeni*	Not Listed	M	The Bryde's whale can be found in tropical and sub-tropical waters throughout the Atlantic, Pacific and Indian Oceans. There appear to be two distinct habitat preferences amongst Bryde's whales, with some populations, usually comprising smaller-bodied individuals, occurring in coastal waters, while other populations can be found in the open ocean, however all Bryde's whales have a preference for warmer water above 16.3 Degrees Celsius.	**Unlikely** - No suitable habitat is present within the Project Area.
Dugong	*Dugong dugon*	Not Listed	M	Shallow, warm (18ºC or above) tropical and sub-tropical coastal waters of the Indian and western Pacific Oceans. Generally occurs in wide shallow protected bays and mangrove channels that support extensive sea grass meadows. Reported to use shallow waters such as tidal sandbanks and estuaries for calving. Australian range from Shark Bay, WA to Moreton Bay, QLD. Occurs in warmer waters south from the Indo-West Pacific to northern NSW.	**Likely** - Individuals of the species are known to occur within the Darwin Harbour and will likely transit the Project area. However, the Project area does not contain key habitat resources for the species such as seagrass and algae foraging areas. Individuals of the species may be periodically sighted offshore in the Darwin Harbour as it moves through foraging areas.
Giant Manta Ray	*Manta birostris*	Not Listed	M	This species is believed to have a wider distribution than the closely related reef manta ray, and is more migratory in its behaviour. It appears to be a seasonal visitor to coastal and offshore sites, and is commonly seen along productive coastlines with regular upwellings, as well as around oceanic islands, offshore pinnacles and seamounts.	**Unlikely** - No suitable habitat is present within the Project Area.
Indo-Pacific Humpback Dolphin	*Sousa chinensis*	Not Listed	M	The Indo-Pacific hump-backed dolphin, is found in tropical and temperate coastal waters of the Indian and Pacific Oceans from northern Australia and southern China in the east, through Indonesia, and around the coastal rim of the Indian Ocean to southern Africa. They are known to enter rivers, estuaries, and mangroves, particularly the latter. They prefer shallow waters <20 m in depth with warm temperatures between 15-36°C. The species is mostly recorded within 10 km of the coast and are on average recorded 2.8 km from the coast.	**Likely** - Suitable habitat for the species is present. The species is widely known from the Darwin Harbour.
Killer Whale, Orca	*Orcinus orca*	Not Listed	M	The orca is found throughout all the world's oceans. The orca occurs in virtually every marine region, from polar waters to the equator, and has even been known to enter bays, estuaries and rivers, as well as ice floes. However, it is most commonly recorded in coastal, temperate waters and in areas of high productivity.	**Unlikely** - The species is unlikely to occur within the Project Area as its preferred habitat is open ocean.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Longfin Mako	*Isurus pacus*	Not Listed	M	Widely scattered records suggest that the longfin mako shark has a worldwide distribution in tropical and warm-temperate oceans; the extent of its range is difficult to determine due to confusion with the shortfin mako. In the Atlantic Ocean, it is known from the Gulf Stream off the East Coast of the United States, the Caribbean, and southern Brazil in the west, and from the Iberian Peninsula to Ghana in the east, possibly including the Mediterranean Sea and Cape Verde. In the Indian Ocean, it has been reported from the Mozambique Channel. In the Pacific Ocean, it occurs off Japan and Taiwan, northeastern Australia, a number of islands in the Central Pacific northeast of Micronesia, and southern California.	**Potential** – Potential to occur within Darwin Harbour.
Narrow Sawfish	*Anoxypristis cuspidata*	Not Listed	M	The Narrow sawfish is found mainly in inshore coastal waters, to depths of around 40 metres, where it is thought to spend most of its time on or near the bottom. It may also enter estuaries and river deltas, and has been reported to move upstream into rivers in some areas, although its occurrence in freshwater has yet to be verified.	**Unlikely** - No suitable habitat is present within the Project Area.
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Not Listed	M	The oceanic whitetip is found globally in deep, open oceans, with a temperature greater than 18 °C, although exceptionally it occurs in water as cold as 15 °C. It prefers waters between 20 and 28 °C and tends to withdraw from areas when temperatures fall outside of these limits. It was once extremely common and widely distributed, and still inhabits a wide band around the globe; however, recent studies suggest that its numbers have drastically declined. An analysis of the US pelagic longline logbook data between 1992 and 2000 (covering the Northwest and Western Central Atlantic) estimated a decline of 70% over that period.	**Potential** – Potential to occur within Darwin Harbour.
Reef Manta Ray	*Manta alfredi*	Not Listed	M	The reef manta ray is found in tropical and sub-tropical waters in the Pacific and Indian Oceans. However, within this widespread range its populations appear to be quite patchy This species is quite widespread in the Indian Ocean, from the Red Sea in the north to South Africa in the south, and from Thailand southwards to Western Australia. It is more commonly found in shallow inshore waters and typically occurs around coastal reefs, tropical island groups, atolls, bays and productive coastlines.	**Unlikely** - No suitable habitat is present within the Project Area.
Salt-water Crocodile	*Crocodylus porosus*	Not Listed	M	The saltwater crocodile is the most widely distributed crocodilian species, ranging from Sri Lanka and the east coast of India in the west, through southeast Asia to Australia. As its common name implies, the saltwater crocodile has a high tolerance for saltwater, aided by salt-excreting glands on the tongue. It may be found in brackish water around coastal areas and rivers, often amongst mangrove forest, as well as occurring further out to sea, and also occurs in freshwater rivers, lakes, swamps and marshes, up to 200 kilometres inland	**Likely** - There is no important habitat for the species located within the project area. Individuals of the species have previously been sighted on boat ramps near the project area. Individuals may also be periodically sighted inside Darwin Harbour.
Shortfin Mako	*Isurus oxyrinchus*	Not Listed	M	The shortfin mako inhabits offshore temperate and tropical seas worldwide. The closely related longfin mako shark is found in the Gulf Stream or warmer offshore waters (for ex., New Zealand and Maine)	**Potential** – Potential to occur within Darwin Harbour.
Spotted Bottlenose Dolphin	*Tursiops aduncus*	Not Listed	M	This species has been found from the west of South Africa to the southern part of Japan and the north, In Australia, the species is restricted to inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands east and west of Australia including the Red Sea. Its habitat varies depending on the tides and the season but includes estuaries, coral reefs and surface waters at high seas, so it tolerates both saltwater and brackish water.	**Likely** - Suitable habitat for the species is present. The species is widely known from the Darwin Harbour.
Migratory Terrestrial/Wetland Species					
Barn Swallow	*Hirundo rustica*	Not Listed	M	Species if found sporadically throughout northern Australia during non-breeding season. The barn swallow is found in vegetated areas including farmland, sports grounds, native grasslands and airstrips as well as over open water such as billabongs, lagoons, creeks and sewage treatment plants.	**Unlikely** - The Project Area does not contain suitable habitat for this species, the closest known record is over 5 km from the Project Area.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Broad-billed sandpiper	*Limicola falcinellus*	Not Listed	M	Shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers; waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches; causeways, riverside lawns, drains and street gutters.	**Unlikely** - The Project Area does not contain suitable habitat for this species, the closest known record is over 5 km from the Project Area.
Common Greenshank	*Tringa nebularia*	Not Listed	M	Species is common throughout Australia from August till March. Found in mudflats, estuaries, saltmarshes, margins of lakes, wetlands, clay pans, fresh and salines, commercial salt fields, sewage ponds.	**Unlikely** - The Project Area does not contain suitable habitat.
Common Sandpiper	*Actitis hypoleucos*	Not Listed	M	Shallow, pebbly, muddy or sandy edges of rivers and streams, coastal to far inland; dams, lakes, sewage ponds; margins of tidal rivers; waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches; causeways, riverside lawns, drains and street gutters.	**Potential** - The Project Area does not contain suitable habitat for nesting/roosting however there is suitable habitat for foraging on either side of the Project Area which may result in this species traversing the Project Area footprint.
Grey Plover	*Pluvialis squatarola*	Not Listed	M	Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or saltlakes.	**Potential** - The Project Area does not contain suitable habitat for nesting/roosting however there is suitable habitat for foraging on either side of the Project Area which may result in this species traversing the Project Area footprint.
Grey-tailed Tattler	*Tringa brevipes*	Not Listed	M	Found in estuaries, tidal mudflats, mangroves, wave-washed rocks and reefs, shallow river margins, coastal or inland. In Australia adults arrive in the north coast from late Aug to early Sep.	**Unlikely** - The Project Area does not contain suitable habitat.
Grey Wagtail	*Motacilla cinerea*	Not Listed	M	Found near running water, disused quarries, sandy rocky streams in escarpments and rainforests, sewage ponds, ploughed fields and airfields. Visitor to Australia from November to April.	**Unlikely** - The Project Area does not contain suitable habitat.
Little Curlew	*Numenius minutus*	Not Listed	M	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and black soil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.	**Unlikely** - While the Project Area does contain some attributes which are known to be utilised by this species (i.e. mudflats), they typically prefer to forage in short grasses which are not present at the site. The closest known record of this species is over 5 km from the Project Area and was recorded 10 years ago.
Little Ringed Plover	*Charadrius dubius*	Not Listed	M	Open plains; bare rolling country, often far from water; ploughed land; muddy or sandy wastes near inland swamps or tidal mudflats; bare clay pans; margins of coastal marshes; grassy airfields, sports fields and lawns. They are a regular summer migrant to Australia from Sep-Mar.	**Unlikely** - The Project Area does not contain suitable habitat.
Long-toed Stint	*Calirdirs subminuta*	Not Listed	M	The long-toed stint breeds in Siberia during the Northern Hemisphere summer. It is a visitor to New Guinea and Australia and a vagrant to Sweden, South Africa, Melanesia, Hawaii, the northwestern USA and the vicinity of the Bering Sea. In its over-wintering range it visits a variety of wetland habitats including shallow freshwater or brackish areas, lakes, swamps, floodplains, marshes, lagoons, muddy shores and sewage ponds.	**Unlikely** - The Project Area does not contain suitable habitat.
Marsh Sandpiper	*Tringa stagnatilis*	Not Listed	M	It is a migratory species, with majority of birds wintering in Africa, and India with fewer migrating to Southeast Asia and Australia. They prefer to winter on freshwater wetlands such as swamps and lakes and are usually seen singly or in small groups. These birds forage by probing in shallow water or on wet mud. They mainly eat insects, and similar small prey.	**Unlikely** - The Project Area does not contain suitable habitat.
Oriental, Horsfield's Cuckoo	*Cuculus optatus*	Not Listed	M	Treated as conspecific with C. saturatus (Himalayan Cuckoo). Inhabits monsoon forests and rainforest edges; leafy trees in paddocks; river flats, roadsides, mangroves and islands.	**Unlikely** - The Project Area does not contain suitable habitat for this species, the closest known record is over 5 km from the Project Area.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Oriental Pratincole	*Glareola maldivarum*	Not Listed	M	Usually inhabits open plains, floodplains or short grassland, often with extensive bare areas. Often occur near terrestrial and artificial wetlands, especially around the margins. This species also occurs along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons. Does not breed in Australia.	**Unlikely** - The Project Area does not contain suitable habitat for this species, the closest known record is over 10 km from the Project Area. This observation was recorded 15 years ago.
Oriental Reed-Warbler	*Acrocephalus orientalis*	Not Listed	M	Rare migrant to coastal North and eastern Australia. Found in dense reeds, cumbungi, over and near water. It breeds mainly in reed beds and can also be found in marshes, paddy fields, grassland and scrub where it forages for insects and other invertebrates.	**Unlikely** - The Project Area does not contain suitable habitat.
Osprey	*Pandion haliaetus*	Not Listed	M	Treated as conspecific with P. Cristatus. The Osprey is thinly distributed around the coast of Australia where they forage for fish in fresh, brackish, or saline waters of rivers, lakes, estuaries and inshore coastal waters. Nests are usually located near a suitable area of foraging habitat and are a bulky structure made from piled sticks, often positioned in a tall dead tree or artificial structures such as telecommunication towers or poles. Breeding pairs defend breeding territory against other Ospreys, and active nests are usually more than 1 km apart.	**Potential** - The Project Area does not contain suitable habitat for nesting/roosting. It is noted that there is an Osprey nest on the DLNG site.
Pacific golden Plover-	*Pluvialis fulva*	Not Listed	M	This species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Usually occur on beaches, mudflats and sandflats in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. Breeding occurs in dry areas of tundra away from the coast, usually on slopes of low hills, knolls or foothills vegetated with lichen and moss, or in bare, stony areas.	**Unlikely** - The Project Area does not contain suitable habitat.
Pectoral Sandpiper	*Calidris melanotos*	Not Listed	M	Species has patchy distribution around Australia's coastline. Found in shallow fresh waters, often with low grass and other herbage; swamp margins, flooded pastures, sewage ponds; occasionally tidal areas and saltmarshes.	**Unlikely** - The Project Area does not contain suitable habitat for the species.
Pin-tailed Snipe	*Gallinago stenura*	Not Listed	M	Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as clay pans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands	**Unlikely** - The Project Area does not contain suitable habitat for the species, the closest known record is over 10 km from the project area.
Red-necked Stint	*Calidris ruficollis*	Not Listed	M	Species are found in tidal mudflats, saltmarshes; sandy or shelly beaches; saline and freshwater wetlands, coastal and inland; salt fields and sewage ponds. They are often in dense flocks, feeding or roosting. Spends the southern summer months in Australia and is found widely except in the arid inland.	**Unlikely** - The Project Area does not contain suitable habitat for the species, the closest known record is over 10 km from the project area.
Red-rumped Swallow	*Cecropis daurica*	Not Listed	M	Migratory bird that spends the winter months in northern Australia. This species is found in open hilly country and mountains, river gorges, valleys, sea cliffs, as well as in cultivated areas and human habitations, including towns.	**Unlikely** - The Project Area does not contain suitable habitat.
Ruddy Turnstone	*Arenaria interpres*	Not Listed	M	Winters on Australian coastlines. Tidal reefs and pools, weed covered rocks, pebbly shelly and sandy shores with stranded seaweed, mudflats, occasionally inland on shallow waters, sewage ponds, commercial salt fields, open or ploughed ground.	**Unlikely** - The Project Area does not contain suitable habitat.
Rufous Fantail	*Rufous rufifrons*	Not Listed	M	The rufous fantail inhabits moist and moderately dense habitats. Within these areas, it has astonishingly large variations in habitat requirements. They can be found in eucalyptus forests, mangroves, rainforests and woodlands (usually near a river or swamp).	**Unlikely** - The Project Area does not contain suitable habitat.
Sanderling	*Calidris alba*	Not Listed	M	Broad ocean beaches of firm sand 'where waves ebb and flow', depositing strands and heaps of seaweed; often near river mouths; also inlets, tidal mudflats and coastal lagoons.	**Unlikely** - The Project Area does not contain suitable habitat.

Common Name	Scientific Name	TPWC Act	EPBC Act	Description/Habitat	Likelihood of Occurrence
Sharp-tailed Sandpiper	*Calidris acuminata*	Not Listed	M	The sharp-tailed sandpiper breeds in northern Siberia but migrates south to winter in Australia and New Zealand. In the non-breeding season they can be found in tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; floodwaters, irrigated pastures and crops; sewage ponds and salt fields.	**Unlikely** - The Project Area does not contain suitable habitat.
Swinhoe's Snipe	*Gallinago megala*	Not Listed	M	Found on northern Australian coastlines. Non-breeding habitats include shallow freshwater wetlands of various kinds including paddy fields and sewage farms, with bare mud or shallow water for feeding, with nearby vegetation cover.	**Unlikely** - The Project Area does not contain suitable habitat for the species, the closest known record is over 10 km from the Project Area.
Terek Sandpiper	*Xenus cinereus*	Not Listed	M	In Australia, the Terek Sandpiper has been recorded on coastal mudflats, lagoons, creeks and estuaries. Records indicate that the species favours muddy beaches near mangroves but may also be observed on rocky pools and coral reefs and occasionally up to 10km inland around brackish pools.	**Unlikely** - The Project Area does not contain suitable habitat.
Wandering Tattler	*Tringa incana*	Not Listed	M	Non-breeding habitats include shallow freshwater wetlands of various kinds including paddy fields and sewage farms, with bare mud or shallow water for feeding, with nearby vegetation cover.	**Unlikely** - The Project Area does not contain suitable habitat.
Whimbrel	*Numenius phaeopus*	Not Listed	M	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sports grounds and lawns.	**Unlikely** - The Project Area does not contain suitable habitat.
Wood Sandpiper	*Tringa glareola*	Not Listed	M	In Australia, the Terek Sandpiper has been recorded on coastal mudflats, lagoons, creeks and estuaries. Records indicate that the species favours muddy beaches near mangroves but may also be observed on rocky pools and coral reefs and occasionally up to 10km inland around brackish pools.	**Unlikely** - The Project Area does not contain suitable habitat.
Yellow Wagtail	*Motacilla flava*	Not Listed	M	Regular summer migrant to coastal Australia, especially Darwin to Broome, but also north-eastern Queensland from November to April. Found in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lands.	**Unlikely** - The project area does not contain suitable habitat for the species with the closest known record over 10 km from the Project Area. This observation was recorded 30 years ago.

CE – Critically Endangered
EN – Endangered
VU – Vulnerable
M - Migratory

Appendix I – Risk Assessment Framework

Environmental Risk Framework

Purpose of the Environmental Risk Framework

The purpose of this environmental risk framework section is to outline the approach used for the assessment of potential impacts of the Project in relation to the NT EPA key environmental factors and objectives, namely Coastal Processes, Marine Environmental Quality and Marine Ecosystems. The framework has been adapted from Santos' environmental risk assessment process to include consequence descriptors relevant to the Project. A residual risk rating has been determined based on the greatest impact for each of the key environment factors and objectives.

Santos Environmental Risk Process

The methodology for this assessment is based on the requirements of AS/NZS 4360:2004 (Risk Management).

The environmental risk framework sets out a method to:

+ establish boundaries for the definition of risk likelihoods and consequences.
+ identify the type of risks associated with the Project.
+ evaluate the risks by ranking them according to the likelihood of the risk and its consequence.
+ outline management measures to mitigate risks to an acceptable level.
+ determine the residual level of risk after application of management measures.

The assessment of risk requires a level of understanding of the nature of activities and how they may interact with the environment, and looks at the causal effect between the aspect (e.g. hazard) and the identified receptor. Impact mechanisms and impacts are determined and described, using scientific literature and modelling where required.

The consequence level of the impact is then determined for each aspect using the Santos Environment Consequence Descriptors (**Table 3**) and applied to the following receptor categories:

+ threatened/migratory/local fauna.
+ physical environment/habitat.
+ threatened ecological communities.
+ protected areas.
+ socio-economic receptors.

The level of information required to complete the impact or risk assessment depends on the nature and scale of the impact or risk. This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. Impacts to social and economic values are also considered based on existing knowledge and feedback from stakeholder consultation. As the result of historic consultation with stakeholders, the social and economic values in the region that are of interest are evident.

As planned events are expected to occur during the activity, the likelihood of their occurrence is not considered during the risk assessment, and only a consequence level is assigned.

For unplanned events, the consequence level of the impact is combined with the likelihood of the impact occurring (**Table 1**), to determine a residual risk ranking using Santos' corporate risk matrix (**Table 2**).

Project risk approach

To determine the residual risk on each of the three key environmental factors and objectives as a result of the Project, the greatest impact to each factor and objective was identified and taken through Santos' risk process of determining a likelihood and consequence rating for that impact following the application of mitigation and management measures. The outcome of the likelihood and consequence rating of the impact is an overarching residual risk rating for each of the three key environmental factors and objectives based on the greatest known impact.

Table 1 Likelihood description

No.	Matrix	Description
F	Almost Certain	Occurs in almost all circumstances OR could occur within days to weeks
E	Likely	Occurs in most circumstances OR could occur within weeks to months
D	Occasional	Has occurred before in Santos OR could occur within months to years
C	Possible	Has occurred before in the industry OR could occur within the next few years
B	Unlikely	Has occurred elsewhere OR could occur within decades
A	Remote	Requires exceptional circumstances and is unlikely even in the long term

Table 2 Risk Matrix

		Consequence					
		I	II	III	IV	V	VI
Likelihood	F	Low	Medium	High	Very High	Very High	Very High
	E	Low	Medium	High	High	Very High	Very High
	D	Low	Low	Medium	High	High	Very High
	C	Very Low	Low	Low	Medium	High	Very High
	B	Very Low	Very Low	Low	Low	Medium	High
	A	Very Low	Very Low	Very Low	Low	Medium	Medium

Table 3 Consequence descriptions

Consequence Level		**I**	**II**	**III**	**IV**	**V**	**VI**
Acceptability		**Acceptable**	**Acceptable**	**Unacceptable**	**Unacceptable**	**Unacceptable**	**Unacceptable**
Consequence Level Description		**Negligible** No impact of negligible impact	**Minor** Detectable but insignificant change to local population, industry or ecosystem factors Localised effect	**Moderate** Significant impact to local population industry or ecosystem factors	**Major** Major long-term effect on local population industry or ecosystem factors	**Severe** Complete loss of local population industry or ecosystem factors AND/OR extensive regional impacts with slow recovery	**Critical** Irreversible impacts to regional population industry or ecosystem factors
Environmental Receptors	**Fauna** In particular, EPBC Act listed threatened/migratory fauna or TPWC Act protected fauna	Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity No decrease in local population size No reduction in area of occupancy of species No loss/disruption of habitat critical to survival of a species No disruption to the breeding cycle of any individual No introduction of disease likely to cause a detectable population decline	Detectable but insignificant decrease in local population size Insignificant reduction in area of occupancy of species Insignificant loss/disruption of habitat critical to survival of a species Insignificant disruption to the breeding cycle of local population	Significant decrease in local population size but no threat to overall population viability Significant behavioural disruption to local population Significant disruption to the breeding cycle of a local population Significant reduction in area of occupancy of species Significant loss of habitat critical to survival of a species Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a significant decline in local population is likely Introduce disease likely to cause a significant population decline	Long term decrease in local population size and threat to local population viability Major disruption to the breeding cycle of local population Fragmentation of existing population Major loss of habitat critical to survival of a species Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a long term decline in local population is likely Introduce disease likely to cause a long term population decline	Complete loss of local population Complete loss of habitat critical to survival of local population Widespread (regional) decline in population size or habitat critical to regional population	Complete loss of regional population Complete loss of habitat critical to survival of regional population
	Physical Environment / Habitat Includes: air quality; water quality; benthic habitat (biotic/abiotic); particularly habitats that are rare or unique; habitat that represents a Key Ecological Feature; habitat within a protected area; habitats that include benthic primary producers and/or epifauna	No or negligible reduction in physical environment / habitat / area / function	Detectable but localised and insignificant loss of area / function of physical environment / habitat. Rapid recovery evident within ~2 year (two season recovery)	Significant loss of area and/or function of local physical environment / habitat. Recovery over medium term (2-10 years)	Major, large-scale loss of area and/or function of physical environment / local habitat. Slow recovery over decades	Extensive destruction of local physical environment / habitat with no recovery Long term (decades) and wide spread loss of area or function of primary producers on a regional scale	Complete destruction of regional physical environment / habitat with no recovery Complete loss of area or function of primary producers on a regional scale

Consequence Level		I	II	III	IV	V	VI
	Threatened ecological communities (EPBC Act listed ecological communities)	No decline in threatened ecological community population size, diversity or function No reduction in area of threatened ecological community No introduction of disease likely to cause decline in threatened ecological community population size, diversity or function	Detectable but insignificant decline in threatened ecological community population size, diversity or function Insignificant reduction in area of threatened ecological community	Significant decline in threatened ecological community population size, diversity or function Significant reduction in area of threatened ecological community Introduction of disease likely to cause decline in threatened ecological community population size, diversity or function	Major, long term decline in threatened ecological community population size, diversity or function Major reduction in area of threatened ecological community Fragmentation of threatened ecological community Introduction of disease likely to cause long term decline in threatened ecological community population size, diversity or function	Extensive, long term decline in threatened ecological community population size, diversity or function Complete loss of threatened ecological community	Complete loss of threatened ecological community with no recovery
	Protected Areas Includes: World Heritage Properties; Ramsar wetlands; Commonwealth/ National Heritage Areas; Land/ Marine Conservation Reserves	No or negligible impact on protected area values No decline in species population within protected area No or negligible alteration, modification, obscuring or diminishing of protected area values	Detectable but insignificant impact on one or more of protected area's values Detectable but insignificant decline in species population within protected area Detectable but insignificant alteration, modification, obscuring or diminishing of protected area values	Significant impact on one or more of protected area's values Significant decrease in population within protected area Significant alteration, modification, obscuring or diminishing of protected area values	Major long term effect on one or more of protected area's values Long term decrease in species population contained within protected area and threat to that population's viability Major alteration, modification, obscuring or diminishing of protected area values	Extensive loss of one or more of protected area's values Extensive loss of species population contained within protected area	Complete loss of one or more of protected area's values with no recovery Complete loss of species population contained within protected area with no recovery
	Socio-economic receptors Includes: fisheries (commercial and recreational); tourism; oil and gas; defence; commercial shipping	No or negligible loss of value of the local industry No or negligible reduction in key natural features or populations supporting the activity	Detectable but insignificant short-term loss of value of the local industry Detectable but insignificant reduction in key natural features or population supporting the local activity	Significant loss of value of the local industry Significant medium term reduction in key natural features or populations supporting the local activity	Major long term loss of value of the local industry and threat to viability Major reduction of key natural features or populations supporting the local activity	Shutdown of local industry or widespread major damage to regional industry Extensive loss of key natural features or populations supporting the local industry	Permanent shutdown of local or regional industry Permanent loss of key natural features or populations supporting the local or regional industry