Santos

Barossa Darwin Pipeline Duplication Environment Plan

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Abbreviations and definitions

Abbreviation	Description
″	inch
°C	Degrees Celsius
µm	Micrometre; 1 µm = 10^{-6} metre = 0.000001 metre or one millionth of a metre.
µPA	micropascal
3D	3-dimensional
AAPA	Aboriginal Areas Protection Authority (Cth)
ABF	Australian Border Force (Cth)
ACMA	Australian Communications and Media Authority (Cth)
ADBAC	alkyl dimethyl benzyl ammonium chloride
AFANT	Amateur Fishers Association Northern Territory
AFFF	aqueous film forming foam
AFMA	Australian Fisheries Management Authority (Cth)
AHO	Australian Hydrographic Office (Cth)
AHT	anchor handling tug
AIMS	Australian Institute of Marine Science (Cth)
ALAN	artificial light at night
ALARP	as low as reasonably practicable
ALR Act	*Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
ALT	Aboriginal Land Trust
AMCS-NT	Australian Marine Conservation Society (NT)
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASBTIA	Australian Southern Bluefin Tuna Industry Association
ASC	Aboriginal Sea Company
ATRF	Arafura Timor Research Facility
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth)
Barossa Development	The Barossa Development includes a Floating Production Storage and Offloading facility, subsea production system, supporting in-field subsea infrastructure and a gas export pipeline within Commonwealth waters. The Barossa Development is further described in the Barossa Development Offshore Project Proposal (OPP); available from: https://docs.nopsema.gov.au/A598153.
Barossa Gas Project	The proposed Barossa Gas Project amalgamates both the infrastructure of the Barossa Development and the DPD Project to extract and process natural gas from the Barossa field.
BIA	biologically important area
BODIS	biodegradability in sea water
CAMBA	China Australia Migratory Bird Agreement
CCNT	Chamber of Commerce Northern Territory
CCWA	Conservation Council of WA
CDU	Charles Darwin University
CEFAS	Centre for Environment, Fisheries and Aquaculture Science (UK)
CFA	Commonwealth Fisheries Association

Abbreviation	Description
CH_4	methane
CHARM	chemical hazard and risk management
CHIRP	compressed high intensity radar pulse
CM	control measure
cm	centimetre
CMID	Common Marine Inspection Document
CMT	crisis management team
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CoA	Commonwealth of Australia
COLREGs	International Regulations for Preventing Collisions at Sea
cP	centipoise
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry (Cth)
DAWDE	Department of Agriculture, Water and the Environment (Cth)
dB	decibel
dB peak	The peak; maximum value reached by the sound pressure; C-weighted scale
dB re 1 µPa	decibels relative to one micro pascal; the unit used to measure the intensity of an underwater sound
dB(A)	decibel; A-weighted scale
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Cth)
DEPWS	Department of Environment, Parks and Water Security (NT)
DEWHA	Department of the Environment, Water, Heritage and the Arts (Cth)
DFAT	Department of Foreign Affairs and Trade (Cth)
DGPS	differential global positioning system
DHAC	Darwin Harbour Advisory Committee
DISER	Department of Industry, Science, Energy and Resources (Cth)
DISR	Department of Industry, Science and Resources (Cth)
DITRDCA	Department of Infrastructure, Transport, Regional Development, Communications and the Arts (Cth)
DITT-NT	Northern Territory Department of Industry, Tourism and Trade
DNP	Director of National Parks
DOA	Department of Agriculture (Cth)
DoD	Department of Defence (Cth)
DoEE	Department of the Environment and Energy (Cth)
DoEH	Department of the Environment and Heritage (Cth)
DoT	Department of Transport (WA)
DP	dynamic positioning
DPD	Darwin Pipeline Duplication is defined as approximately 23 km of pipeline in Commonwealth waters
DPD (NT)	Darwin Pipeline Duplication (Northern Territory) is defined as approximately 100 km of pipeline in Northern Territory waters
DPD Offshore CEMP	Darwin Pipeline Duplication Offshore Construction Environmental Management Plan (Northern Territory coastal waters)
DPD Project	Darwin Pipeline Duplication Project is a proposal to install approximately 123 km of pipeline—comprising of approximately 23 km in Commonwealth waters (covered under this EP) and 100 km in Northern Territory waters (outside the scope of this EP). The DPD Project is further described in the

Abbreviation	Description
	Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) referral (EPBC 2022/09372).
DPIF	Department of Primary Industries and Fisheries
DPIRD	Department of Primary Industries and Regional Development (WA)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Cth)
DTFHC-NT-Heritage	Department of Territory Families, Housing and Communities, Northern Territory Heritage branch
e.g.	for example
EC_{10}	a concentration or dose that yields biological effects in 10% of test animals/species
EC_{50}	median effective concentration, concentration at which 50% of the test organisms are immobilised
ECNT	Environment Centre Northern Territory
EDO	Environmental Defenders Office
EEZ	exclusive economic zone
ELC_{50}	median effective concentration, concentration at which 50% of the test organisms are results in death
EMBA	environment that may be affected
ENE	east–north–east
ENVID	environmental hazard identification workshop
EP	environment plan
EPA (NT)	Environment Protection Authority (Northern Territory)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPBC Regulations	*Environment Protection and Biodiversity Regulations 2000* (Cth)
EPO	environmental performance objective
EPS	environmental performance standard
ErC_{50}	median effective concentration, concentration which results in a 50% reduction in algal growth
ESD	ecologically sustainable development
ESE	east–south–east
FCGT	flood, clean, gauge and pressure testing
FDA	Food and Drug Administration (US)
FME	full moon equivalents
FNCC	First Nations consultative committee
FPSO	floating production, storage and offloading
FRDC	Fisheries Research Development Council
g/m^2	gram per square metre
GDA	Gwalwa Daraniki Association
GDA94	Geocentric Datum of Australia 1994
GEP	gas export pipeline
GHG	greenhouse gas
GMDSS	Global Maritime Distress and Safety System
h	hour
ha	hectare
HF	high frequency
HFO	heavy fuel oil
HOCNF	harmonised offshore chemical notification format

Abbreviation	Description
hp	horsepower
HQ	hazard quotient
HSE	health, safety and environment
Hz	hertz
i.e.	that is
IAPP	International Air Pollution Prevention
IBC	intermediate bulk container
IEE	International Energy Efficiency
IFO	intermediate fuel oil
ILSC	Indigenous Land and Sea Corporation
ILUA	Indigenous land use agreement
IMCA	International Maritime Contractors Association
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organization
IMP	introduced marine pest
IMR	inspection, maintenance and repair activities
IMS	invasive marine species
IMT	incident management team
INMARSAT-C	International Maritime Satellite C
IOPP	International Oil Pollution Prevention
IPA	Indigenous Protected Areas
IPIEC	International Association of Oil & Gas Producers
ISO	International Organization for Standardization
ISPP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
JAMBA	Japan Australia Migratory Bird Agreement
JRCC	Joint Rescue Coordination Centre
KEF	key ecological feature
kg	kilogram
kHz	kilohertz
KLC	Kimberley Land Council
km	kilometre
km^2	square kilometre
KNPMP	Kakadu National Park Management Plan 2016–2026
kW	kilowatt
L	litre
L/kg	litres per kilogram
LAT	lowest astronomical tide
LBL	long baseline
LC_{50}	concentration at which there is mortality of 50% of a group of specific test species
LDC	Larrakia Development Corporation
LE	cumulative sound exposure over a 24 h period

Abbreviation	Description
LED	light-emitting diode
LF	low frequency
LNAC	Larakia Nation Aboriginal Corporation
LNG	liquefied natural gas
LOEC	lowest observed effect concentration
m	metre
m^2	square metre
m^3	cubic metre
MAHA	maritime archaeological heritage assessment
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978; also known as MARPOL 73/78
MARS	Maritime Arrivals Reporting System
MBES	multibeam echo sounder
MC	measurement criteria
MDO	marine diesel oil
MEG	monoethylene glycol
MEVA	moderate exposure value area
MFE	mass flow excavation
MFO	marine fauna observer
mg/L	milligrams per litre
MGO	marine gas oil
MLBE	mooring line buoyancy element
mm	millimetre
MMO	marine mammal observer
MNES	matters of national environmental significance
MoC	management of change
MODU	mobile offshore drilling unit
MoU	memorandum of understanding
MPNMP	Marine Park Network Management Plan
MSI	maritime safety information
Mt	million tonnes
Munkara	*Munkara v Santos NA Barossa Pty Ltd (No 3)* [2024] FCA 9
N/A	not applicable
N_2O	nitrous oxide
NAILSMA	North Australia Indigenous Land and Sea Management Alliance
NAXA	North Australian Exercise Area
NEBA	net environmental benefit analysis
NEPM	National Environment Protection Measures
NFS	National Science Foundation
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act 2007* (Cth)
NH_4HSO_3	ammonium bisulfite
NIAA	National Indigenous Australians Agency

Abbreviation	Description
NLC	Northern Land Council
Nm	nautical mile
NMFS	National Marine Fisheries Service (US)
NMR	North Marine Region
NOAA	National Oceanic and Atmospheric Administration (US)
NOEC	no observed effect concentration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NO_x	oxides of nitrogen
NPF	Northern Prawn Fishery
NPFI	Northern Prawn Fishery Industry
NSF	National Science Foundation (US)
NSW	New South Wales
NT	Northern Territory
NT Act	*Native Title Act 1993* (Cth)
NTASS Act	*Northern Territory Aboriginal Sacred Sites Act 1989* (NT)
NTGFIA	Northern Territory Guided Fishing Industry Association
NTSC	Northern Territory Seafood Council
NW	north–west
NWMR	North-West Marine Region
OA	Operational area. Refer to Section 2.3 for a definition.
OCIMF	Oil Companies International Marine Forum
OCNS	Offshore Chemical Notification Scheme
ODS	ozone-depleting substance
OECD	Organisation for Economic Co-operation and Development
OFOV	orientation field of view
OIW	oil in water
OPEP	oil pollution emergency plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth)
OPGGS(E)R	*Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth)
OPP	offshore project proposal
OPRC 90	Convention on Oil Pollution Preparedness, Response and Co-operation 1990
OSPAR	Oslo–Paris Convention for the Protection of the Marine Environment of the North East Atlantic
OVID	Offshore Vessel Inspection Database
PC	protection concentration; e.g. PC99 is 99% protection concentration, PC95 is 95% protection concentration etc.
PFAS	perfluorinated sulfonate
PFOS	perfluorooctane sulfonate
pig	Defined as a tool used to clean, gauge and inspect a pipeline
PK	peak sound pressure
PLET	pipeline end termination
PLONOR	pose little or no risk
PMST	Protected Matters Search Tool

Abbreviation	Description
PNEC	predicted no effect concentration
POB	persons on board
ppb	parts per billion
ppm	parts per million
PPUCH	Protocol for Protecting Underwater Cultural Heritage
PTS	permanent threshold shift
PWCNT	Parks and Wildlife Commission of the Northern Territory
PWSNT	Parks and Wildlife Service Northern Territory
Q1, Q2, etc.	3-monthly quarter of a calendar year; e.g. Q1 = January to March
Ramsar	Convention on Wetlands of International Importance
Rmax	maximum range
ROV	remotely operated vehicle
RPS APASA	RPS Asia-Pacific Applied Science Associates (company)
SBES	single beam echo sounder
SBP	sub-bottom profiler
SCR	Santos Client Representative
SDS	safety data sheet
SE	south–east
SEL	sound exposure level
SEL_{cum}	cumulative sound exposure level
SIMAP	Spill impact model application package
SITREP	situation report
SMPEP	shipboard marine pollution emergency plan
SO_2	sulfur dioxide
SOLAS	(International Convention for the) Safety of Life at Sea
SOPEP	shipboard oil pollution and emergency plan
SPL	sound pressure level
SSS	side-scan sonar
STCW	International Convention on Standards of Training, Certification and Watchkeeping
t	tonne
T&I	transport and installation
Territory NRM	Territory Natural Resource Management
TLC	Tiwi Land Council
TPWC Act	*Territory Parks and Wildlife Conservation Act 1976* (NT)
TSSC	Threatened Species Scientific Committee
TTS	temporary threshold shift
TWS	The Wilderness Society
UCH	Underwater Cultural heritage
UCH Act	*Underwater Cultural Heritage Act 2018* (Cth)
UK	United Kingdom
US	United States
USBL	ultra short baseline
USV	uncrewed surface vessels

Abbreviation	Description
UV	ultraviolet
UXO	Unexploded ordnance
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WHO	World Health Organization
WSW	west–south–west
WWF	World Wildlife Fund

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1. Introduction

1.1 Environment plan summary

Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R 2023) requirements
Section 35. Notice of decision on environment plan, publication of accepted plan and submission and publication of summary
Submission of summary of accepted plan (6) Within 10 days after receiving notice that NOPSEMA has accepted an Environment Plan (EP) (whether in full, in part or subject to limitations or conditions), the titleholder must submit a summary of the accepted plan to NOPSEMA for public disclosure. (7) The summary: a. must include the following material from the environment plan for the activity: i. the location of the activity; ii. description of the receiving environment; iii. a description of the activity; iv. details of environmental impacts and risks of the activity; v. a summary of the control measures for the activity; vi. a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance; vii. a summary of the response arrangements in the oil pollution emergency plan; viii. details of consultation already undertaken, and plans for ongoing consultation; ix. details of the titleholder's nominated liaison person for the activity; and b. must be to the satisfaction of NOPSEMA.

A summary will be prepared as required by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS[E]R) section 35(7) drawing on the following sections of this EP.

EP summary material requirement	Relevant section of EP containing EP summary material
The location of the activity	Section 2
A description of the receiving environment	Section 3 and Appendix D
A description of the activity	Section 2
Details of the environmental impacts and risks	Sections 6 and 7
The control measures for the activity	Sections 6 and 7
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 8
Response arrangements in the oil pollution emergency plan	Section 8.5 and DPD Installation in Commonwealth Waters Oil Pollution Emergency Plan (OPEP) (BAS-210 0131).
Consultation already undertaken and plans for ongoing consultation	Sections 4 and 8
Details of the titleholders nominated liaison person for the activity	Section 1.5.1

1.2 Activity overview

Santos NA Barossa Pty Ltd (Santos) proposes to install approximately 23 km of pipeline, as part of the Darwin Pipeline Duplication (DPD) Project, and supporting subsea infrastructure and undertake pre-commissioning activities. This is more simply referred to as the 'Activity'.

The Activity is proposed within Commonwealth waters, approximately 95 km north-west of Darwin, Northern Territory (NT) and approximately 25 km south-west of the Tiwi Islands, NT, within the boundaries of the petroleum pipeline licence (NT/PL6) (Figure 1-1).

The petroleum activity covered in this EP forms part of the Barossa Gas Project. The proposed Barossa Gas Project amalgamates both the infrastructure of the Barossa Development and the DPD Project to extract and process natural gas from the Barossa field.

The Barossa Development includes a Floating Production Storage and Offloading (FPSO) facility, subsea production system, supporting in-field subsea infrastructure and a gas export pipeline (GEP) within Commonwealth waters. The Barossa Development is further described in the Barossa Development Offshore Project Proposal (OPP) (ConocoPhillips, 2018), which was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in March 2018.

The DPD Project involves the proposal to install approximately 123 km of pipeline—comprised of approximately 23 km in Commonwealth waters (DPD) (covered under this EP) and 100 km in NT waters (DPD [NT]) (outside the scope of this EP). The DPD Project is described in the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) referral (EPBC 2022/09372). The DPD Project was determined to be a controlled action and approved by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the EPBC Act.

This EP identifies and evaluates environmental impacts and risks associated with the Activity.

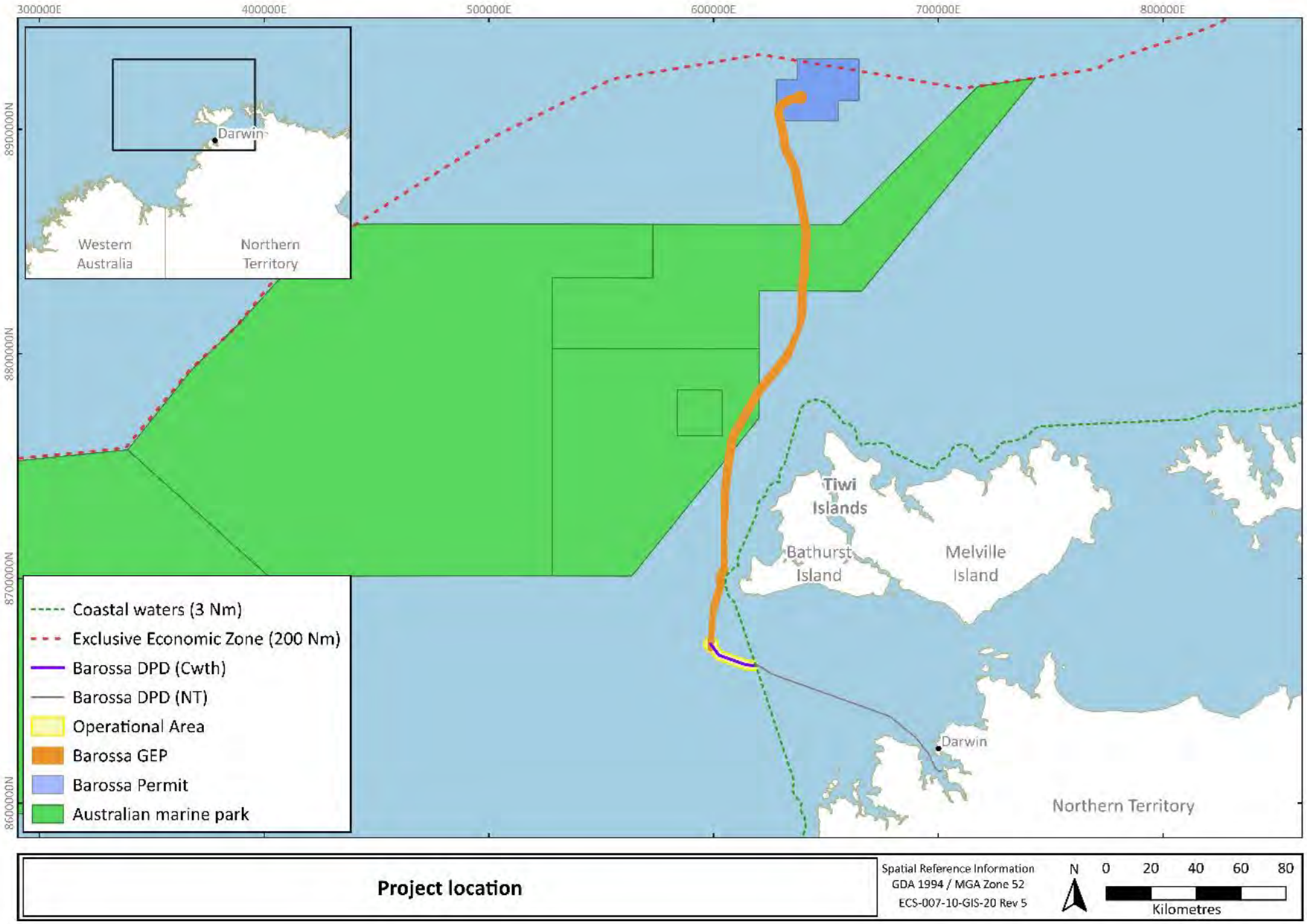


Figure 1-1: Location of proposed activity

1.3 Purpose of this Environment Plan

OPGGS(E)R 2023 Requirements
Section 34. Criteria for acceptance of environment plan
For the purposes of section 34, the criteria for acceptance of an environment plan (the environment plan acceptance criteria) for an activity are that the plan: a. is appropriate for the nature and scale of the activity; and b. demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and c. demonstrates that the environmental impacts and risks of the activity will be of an acceptable level; and d. provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria; and e. includes an appropriate implementation strategy and monitoring, recording and reporting arrangements; and f. does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property; and g. demonstrates that: i. the titleholder has carried out the consultations required by section 25; and ii. the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate; and h. complies with the Act, this instrument and any other regulations made under this Act.

This EP has been prepared in accordance with the OPGGS(E)R for submission to and acceptance by NOPSEMA.

In accordance with the OPGGS(E)R, this EP details the environmental impacts and risks associated with the activity and demonstrates how these will be reduced to as low as reasonably practicable (ALARP) and to an acceptable level. The EP's implementation strategy will be used to measure and report on environmental performance to demonstrate that impacts and risks are being continuously reduced to ALARP and are at an acceptable level. The environmental management of the Activity described in the EP complies with Santos' Environment, Health and Safety Policy (Appendix A) and with all relevant legislation (Appendix B). This EP documents and considers all relevant consultation undertaken during the development of the EP (Section 4).

1.4 Environment plan validity

The operation of this EP commences on the date it is accepted by NOPSEMA, and continues until submission and acceptance by NOPSEMA of a notification made pursuant to section 46 of the OPGGS(E)R. There will be an interim preservation period from the end of pre-commissioning activities to the commencement of the activities covered under the future Barossa Production Operations EP. The end-of-operation of EP notification will occur at the completion of the interim preservation period. Activities undertaken during the preservation period are within the scope of this EP.

Santos may revise this EP, using the Management of Change (MoC) process described in Section 8.9.2.

1.5 Operator and titleholder details

OPGGS(E)R 2023 Requirements
Section 23. Details of titleholder and nominated liaison
(1) The environment plan must include the following details for the titleholder: a. name; b. business address; c. telephone number (if any); d. fax number (if any); e. email address (if any); f. if the titleholder is a body corporate that has an Australian Company Number (ACN) (within the meaning of the Corporations Act 2001). (2) The environment plan must also include the following details for the titleholder's nominated liaison for the activity a. name; b. business address; c. telephone number (if any); d. fax number (if any) e. email address (if any). (3) The environment plan must include arrangements for notifying NOPSEMA of any of the following: a. a change in the titleholder; b. a change in the titleholder's nominated liaison for the activity; c. a change in the contact details for either the titleholder or the nominated liaison.

The titleholder details are provided in Table 1-1, with the nominated operator shown in bold.

Table 1-1: Titleholder details for the Activity

Title	Titleholder (nominated operator in bold)	ACN	Interest (%)	Contact details
Petroleum pipeline licence (NT/PL6)	**Santos NA Barossa Pty Ltd**	109 974 932	25.0	Business address: Level 7, 100 St Georges Terrace, Perth WA 6000 Phone: (08) 6218 7100 Fax: (08) 6218 7200 Email: barossa.regulatory@santos.com
	Santos Offshore Pty Ltd	005 475 589	25.0	
	SK E&S Australia Pty Ltd	158 702 071	37.5	Business address: Level 27, 152–158 St Georges Terrace, Perth WA 6000 Phone: (08) 6186 2320 Fax: None Email: upstream@sk.com
	JERA Barossa Pty Ltd	654 004 387	12.5	Business address: Level 36, QV1, 250 St Georges Terrace, Perth WA 6000 Phone: (08) 6311 7610 Fax: (08) 6311 7613 Email: barossa@jeraaustralia.com.au

1.5.1 Details for nominated liaison person

Details for Santos' nominated liaison person for the Activity are:

Name: Michael Marren
Business address: Level 7, 100 St Georges Terrace, Perth WA 6000
Phone: (08) 6218 7100
Email: offshore.consultation@santos.com

1.5.2 Notification procedure in the event of changed details

If there is a change in the nominated titleholder, the titleholder's nominated liaison person, or a change in the contact details for the titleholder or liaison person, Santos will notify NOPSEMA and provide the updated details by email.

1.6 Environmental management framework

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Requirements (4) The environment plan must: a. describe the requirements, including legislative requirements, that apply to the activity and are relevant to the environmental management of the activity; and b. demonstrate how those requirements will be met.
Section 24. Other information in the environment plan
The environment plan must contain the following: a. a statement of the titleholder's corporate environmental policy.

1.6.1 Santos' environment, health and safety policy

The activity will be conducted in accordance with Santos' Environment, Health and Safety Policy presented in Appendix A.

Sections 3, 4, 6, 7 and 8 reflect this policy, detailing and evaluating environmental impacts and risks and providing control measures with set environmental performance outcomes (EPOs) and standards (EPSs).

1.6.2 Relevant environmental legislation

Relevant legislative and other requirements are presented in Appendix B, inclusive of the relevant EP sections where the requirement may prescribe or control how an activity is undertaken. Australia is a signatory to numerous international conventions and agreements relevant to the Activity. Relevant government departments have been consulted during the development of this EP so as to promote compliance with relevant legislation, conventions and agreements, as detailed in Section 4.

2. Activity description

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Description of the activity (1) The environment plan must contain a comprehensive description of the activity including the following: a. the location or locations of the activity; b. general details of the construction and layout of any facility that is used in undertaking the activity; c. an outline of the operational details of the activity (e.g. seismic surveys, exploration drilling or production) and proposed timetables for undertaking the activity; and d. any additional information relevant to consideration of environmental impacts and risks of the activity. *Note: An environment plan will not be capable of being accepted by NOPSEMA if an activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, will be undertaken in any part of a declared World Heritage property (see section 34 of the OPGGS(E)R 2023 Requirements).*

2.1 Activity summary

The DPD Project infrastructure has been designed to connect to the existing GEP (refer to Figure 1-1). The DPD Project consists of approximately 123 km of pipeline, including 100 km of pipeline in NT waters (referred to as the DPD (NT) and outside the scope of this EP) and 23 km of pipeline in Commonwealth waters (referred to as the DPD). This EP provides for the DPD Project activities in Commonwealth waters, which comprise the key infrastructure Table 2-1 and Figure 2-3 (referred to as the Activity). It also provides for the pre-commissioning discharge volumes for both the DPD and DPD (NT).

The following infrastructure and associated activities are excluded from the scope of this EP:

- installation and pre-commissioning activities of the GEP (includes installation of GEP pipeline end termination [PLET] and the GEP), which are covered under the NOPSEMA-accepted Barossa Gas Export Pipeline Installation EP; referred to as GEP EP.
- drilling, completion and well management activities, which are covered under the NOPSEMA-accepted Barossa Development Drilling and Completions EP; referred to as D&C EP.
- installation and pre-commissioning activities of the subsea umbilicals, risers and flowlines and FPSO moorings, which are covered under the NOPSEMA-accepted Barossa Subsea Infrastructure and FPSO Moorings Installation and Pre-commissioning EP; referred to as SURF EP.
- installation and operations of the DPD (NT), assessed under the EPBC Act and other relevant Commonwealth and NT legislation
- commissioning, start-up and operation activities (includes FPSO and the submerged turret production buoy to FPSO hook-up), which will be covered under the Barossa Production Operations EP (currently under development)
- end-of-life decommissioning activities, which will be covered under the future Decommissioning EP (see Section 2.10).

Table 2-1: Summary of key infrastructure and activities

Description
Infrastructure and supporting structures
Infrastructure: • Barossa DPD: approximately 23 km of 26-inch outer diameter carbon steel, concrete coated pipeline • PLET with protection structure • spool: approximately 90 m of 26-inch diameter carbon steel pipeline with a variety of coatings including asphalt enamel, high build epoxy, concrete weight coating and 3–layer polypropylene (PP) Supporting structures: • PLET foundation • spool mattresses • scour protection and span rectification structures (includes mattresses and grout bags) Temporary installation aids and equipment:

Description
• underwater acoustic positioning equipment, internal lifting tools, installation rigging, Remotely Operated Vehicle [ROV] baskets, pig launcher and receiver, survey equipment and PLET diffuser
Key activities
Vessel activities include: • surveys (pre-lay, as-laid and post-lay; magnetometer, post cyclone and cathodic protection, if required) • delivering and transferring linepipe (sections of pipe) to the pipelay vessel • installation and removal of underwater acoustic positioning equipment • remove, wet park then re-install the GEP PLET protection structure (during spool tie-in) • seabed rectification for span correction, and scour protection, if required • supporting structures installation: – PLET foundation and spool mattresses – scour protection structures and span rectification (includes mattresses and grout bags) • infrastructure installation: – Barossa DPD – PLET and PLET protection structure – spool • pre-commissioning: – flood, clean, gauge and pressure testing (FCGT) – dewatering – preconditioning – nitrogen packing – spool leak testing and MEG flushing • unplanned and non-routine inspection, maintenance and repairs (IMR)[1] • bunkering • preservation period – non-production – unplanned IMR activities
Activity vessels
• pipelay vessel[2] • construction vessels[2] • survey vessels[2] • support and supply vessels (such as pipe supply, barges, tugs, IMR[2] and general cargo) These are collectively referred to as ‘activity vessels’ throughout this EP.
Other support
• helicopters • remotely operated vehicles (ROVs)

[1] *Provision also includes the preservation period.*

[2] *Vessel typically equipped with ROVs.*

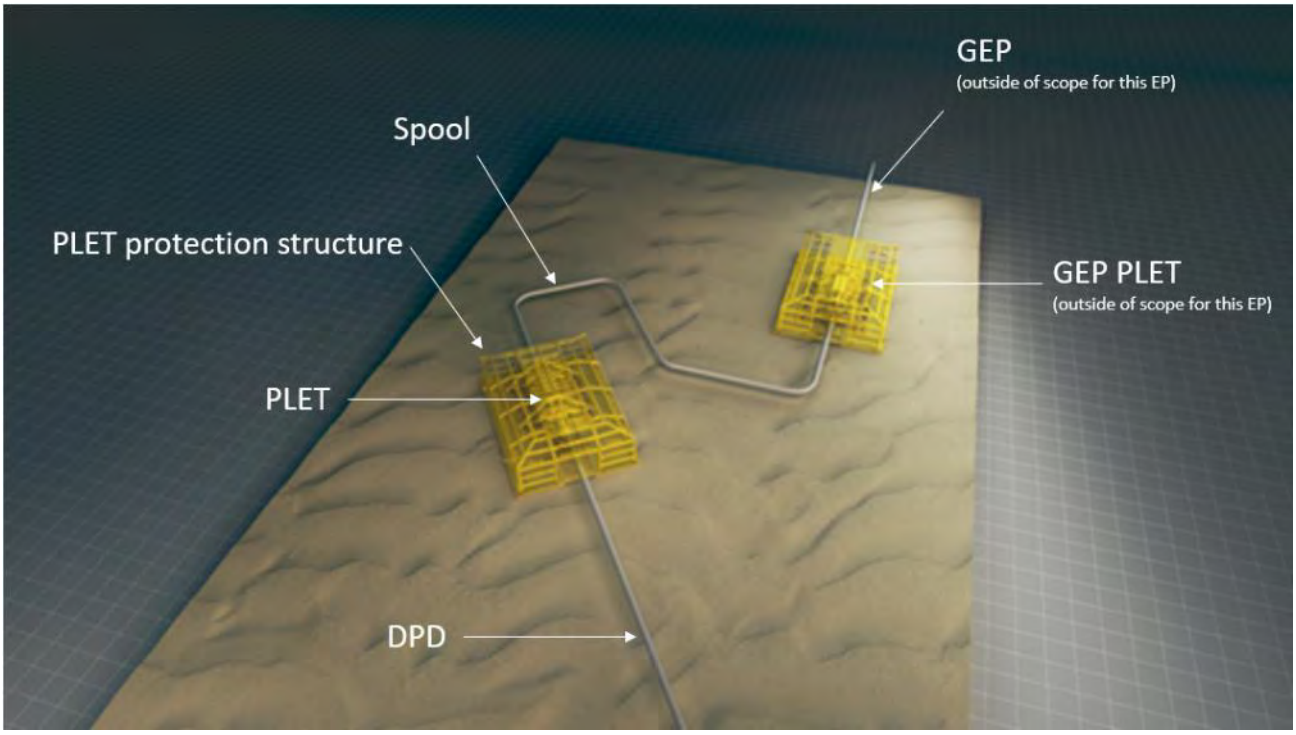


Figure 2-1: Indicative key DPD infrastructure layout

2.2 Location and tenure

The Activity will be undertaken within Commonwealth waters, approximately 95 km north-west of Darwin, NT. The operational area (OA) and DPD route are approximately 25 km and 27 km south-west of the Tiwi Islands, NT respectively and approximately 44 km south-east of the Oceanic Shoals Marine Park (Figure 1-1).

2.3 OA, tenure, and timing

The OA covered under this EP is the area within which all planned activities will occur. The OA is defined as approximately a 3,000 m radius around the PLET and a 2,000 m buffer either side of the DPD route, with a reduced buffer in some sections to meet project requirements. To allow for localized re-routing, there is a 250 m allowance on either side of the DPD route, if required. The OA encompasses the installation of the key infrastructure, as well as the activity vessel movements. The infrastructure will be installed within the boundaries of the petroleum pipeline licence (NT/PL6).

Table 2-2 lists the coordinates of the key infrastructure; Figure 2-2 shows the location and OA.

Table 2-2: DPD and infrastructure coordinates

Point	Location	Description	Easting	Northing	Latitude	Longitude	Water depth (m)
1	PLET/spool/ DPD KP0	Infrastructure and end location of DPD	598754	8670734	12° 01′ 23″ S	129° 54′ 26″ E	54 m
2	DPD ~KP23	Start of DPD; Commonwealth/NT boundary	618796	8661045	12° 06′ 36″ S	130° 05′ 30″ E	50 m

Source: Datum GDA94

The total duration of the Activity—excluding the preservation period—is estimated to be 3 months, subject to vessel availability, supply chain issues, operational efficiencies and weather conditions. The Activity is estimated to commence between Q3 2024 and Q2 2025, subject to obtaining regulatory and business approvals and pipelay vessel availability. The Activity is planned to occur 24 hours per day, 7 days a week.

The total duration of the preservation period (see Section 2.8) is estimated to be approximately 6 months, subject to obtaining regulatory and business approvals and the commencement of activities under the future Barossa Production Operations EP.

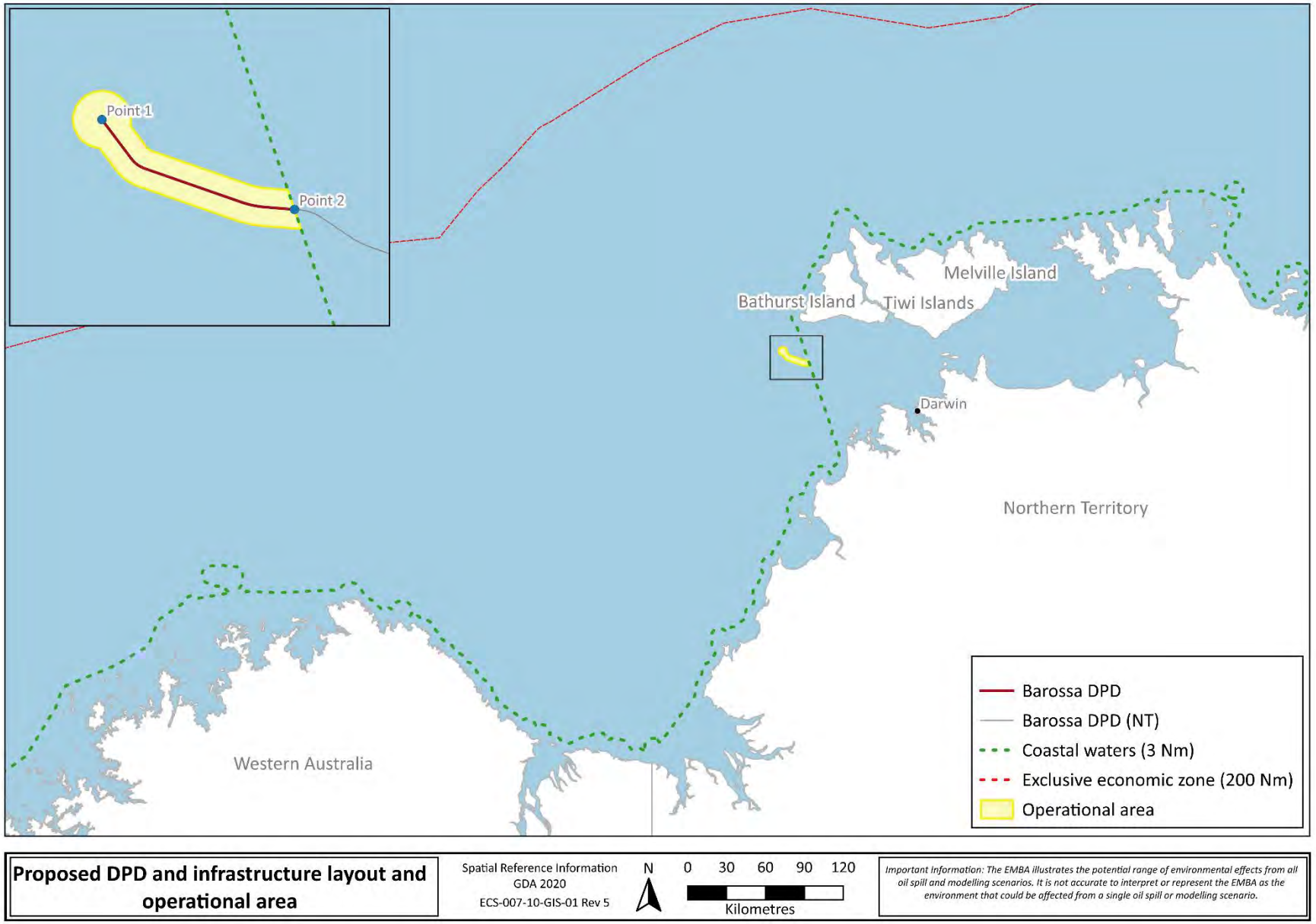


Figure 2-2:Proposed infrastructure and OA

2.4 Vessels and support activities

Multiple vessel types will be required to complete the activities within the OA to support the Activity and interim preservation period, as required. Table 2-3 summarises the indicative activities for each vessel type that may be required. The indicative activities listed for each vessel type may change or be undertaken by another activity vessel type due to project schedule requirements, vessel availability or unforeseen circumstances.

For the purposes of assessing the cumulative environmental impacts of multiple vessels working within the OA at any given time, it is assumed that the 2 largest vessels, the pipelay and construction vessels will work alongside each other. This is important to assess aspects such as cumulative lighting or noise impacts. It is noted that support or supply vessels may also be in the vicinity of the pipelay and construction vessels temporarily.

Table 2-3: Vessel and support types that may be used for activities

Type	Indicative activities
Pipelay vessel	• install PLET and DPD, including ROV support and touchdown monitoring • undertake bunkering • undertake unplanned and non-routine IMR activities • undertake other support to implement control measures
Construction vessels	• undertake surveys • install supporting structures (PLET foundation and spool mattresses, scour protection and span rectification structures [mattresses and grout bags]) • undertake seabed rectification, if required • install and recover of underwater acoustic positioning equipment • install spool • install PLET protection structure • remove, wet park then re-install GEP PLET protection structure (during spool tie-in) • undertake support activities (ROV support and touchdown monitoring, subsea positioning and placement) • undertake pre-commissioning activities • undertake bunkering • undertake unplanned and non-routine IMR activities • undertake other support to implement control measures
Survey vessels	• undertake surveys, inspections and non-routine IMR activities • support installation activities, including ROV support • undertake bunkering • undertake support activities
Support and supply vessels	• transport the following to the pipelay or construction vessels: – materials and fuel – transport of infrastructure and supporting structures – support and supplies – transport of vessel waste and debris (if required) from vessels to mainland for disposal • transport materials and fuel to the survey vessel • support the survey vessel (e.g. maintenance activities) • support and monitor installation, pre-commissioning and preservation activities • undertake surveys and inspections • crew transfers • undertake unplanned and non-routine IMR activities • undertake other support to implement control measures
Helicopters	• crew transfers • undertake refuelling, as required • provide miscellaneous supplies • undertake medivac, if required
ROVs	• support and monitor installation, pre-commissioning and unplanned and non-routine IMR activities

Type	Indicative activities
	• undertake surveys and inspections • undertake other support to implement control measures • undertake localised stabilisation, span rectification and unplanned local seabed rectification

Activity vessels will be selected and onboarded in accordance with Santos' Offshore Marine Assurance Procedure (SO-91-ZH-10001) to ensure contracted vessels are operated, maintained and crewed in accordance with industry standards, regulatory requirements (e.g. this EP and Marine Orders) and the relevant Santos procedures mentioned in this EP. The marine assurance process includes close inspection of vessel suitability, equipment and design, and personnel training, including officer experience.

Single beam echo sounder (SBES) equipment may be fitted and used on activity vessels to provide seabed depth measurements. This equipment is required to be fitted to all vessels over 300 gross tonnage under SOLAS – Part 1 - Chapter V – Safety of Navigation – Regulation 19 – Carriage Requirement for Shipborne Navigational Systems and Equipment. SBES equipment uses a hydrographic technique measuring the two-way travel time of a high-frequency sound pulse emitted by a transducer.

Vessels will generate and manage solid wastes. Vessels will also undertake routine discharges and emissions, as listed in Table 2-9. Activity vessels may be bunkered (refuelled) within the OA (Section 2.5.5).

2.4.1 Pipelay vessel

The Barossa DPD and PLET will be installed using a specialised pipelay vessel, such as the *Audacia* (Figure 2-3). See Table 2-4 for a typical pipelay vessel specification.

The pipelay vessel will be typically equipped with:

- enclosed firing line
- a pipelay system
- cranes
- dynamic positioning (DP) systems
- ROV (Refer to Table 2-6 for typical ROV specifications)
- helideck and helicopter refuelling system.

Figure 2-3: Indicative pipelay vessel (*Audacia*)

Table 2-4: Typical specification for a pipelay vessel (based on *Audacia*)

Item	Description
Length	327 m
Gross tonnage	56,172 t
Total persons on board (POB)	Up to 270
Lighting	Navigational, deck, task-specific and emergency lighting
Ballast system	Ballast systems can vary in size with total volumes from 20,000 m³ to 32,000 m³
Freshwater system	Evaporators/distillation units on board Freshwater tanks vary in size from 1,000 m³ to 1,500 m³
Cooling system	Sea water used to cool main engines, refrigerators and service cooling; sea water is circulated by pumps
Sewage system	International Maritime Organisation/International Convention for the Prevention of Pollution from Ships (IMO/MARPOL) compliant sewage treatment plants
Putrescible waste system	MARPOL-compliant comminuting (grinding) system
Incinerators	MARPOL-compliant incinerators
Fuel tanks	Multiple isolatable fuel tanks with total capacity 5,547 m³ (no single tank will exceed 1,118 m³)
Power generation	39,800 kW

2.4.2 Construction vessels

Specialised construction vessels, like the *Fortitude* (Figure 2-4), will be used for the activities outlined in Table 2-3. Refer to Table 2-5 for typical construction vessel specifications based on *Fortitude*. These specifications are typical and may not apply to all construction vessels.

Construction vessels will be typically equipped with:

- cranes
- DP system
- ROVs (Refer to Table 2-6 for typical ROV specifications)
- helideck and helicopter refuelling system.

Figure 2-4: Indicative construction vessel (*Fortitude*)

Table 2-5: Typical specification for a construction vessel (based on *Fortitude*)

Vessel Systems	Typical Characteristics
Length	151 m
Gross tonnage	23,520 t
Total POB	Up to 250
Lighting	Navigational, deck, task-specific and emergency lighting
Ballast system	8,494 m^3
Freshwater system	Reverse osmosis and distiller units: • potable water capacity: 1,596 m^3 • fresh water capacity: 131.5 m^3
Sewage system	IMO/MARPOL-compliant sewage treatment plants
Putrescible waste system	MARPOL-compliant comminuting (grinding) system
Incinerators	MARPOL-compliant incinerators
Fuel tanks	Maximum single fuel tank is 296 m^3
Power generation	22,380 kW

2.4.3 Survey vessels

Marine survey vessels, construction or other support vessels may be used for activities outlined in Table 2-3. Marine survey vessels are generally 60 to 90 m long with a crew capacity of up to 50 persons or uncrewed. Remotely operated uncrewed surface vessels (USV) will be used for launching electrical ROVs to undertake surveys to support pipelay vessels. The USV may also support activities listed in Table 2-3 and perform work using the launched ROV, as required. The USV will be supported by a crewed support vessel. The USV would be operated remotely by a Vessel Master at a remote operations centre and a support vessel would be available in Darwin should any assistance be required. Typical USV size is in the order of 12 m long and 2.3 m wide with a hybrid propulsion system and a fuel tank of nominally 4 m^3. They are typically fitted with radars, an emergency anchor, loud speaker, night vision, navigational lighting, 360º camera and VHF radio.

ROVs may be used to support surveys, using visual or geophysical techniques (such as side-scan sonar [SSS] and multibeam echo sounder [MBES]).

2.4.4 Support and supply vessels

Support and supply vessels may be used for the activities outlined in Table 2-3. Support and supply vessels may transit between the OA to port (e.g. Darwin and international ports) and mooring locations. Pipeline is likely to be supplied daily during the Activity. Supply vessels typically have a crew capacity of nominally 16 persons. Support vessels typically have a crew capacity of nominally 12 persons.

2.4.5 Other support

2.4.5.1 Helicopters

Table 2-3 lists the helicopter activities. Helicopter operations may include offshore helicopter refuelling on vessel helidecks within the OA, subject to flight distances and the weight of the loads the helicopter will carry. There will be approximately 30 helicopter movements throughout the Activity with a peak utilisation of approximately 10 times a week.

2.4.5.2 ROVs

Table 2-3 lists the indicative activities and Table 2-6 lists the specifications for typical ROV operations. Typical ROVs are operated using hydraulic control fluids (synthetic blend base oil), with the largest hydraulic control fluid tank being 5 L and equipped with work-baskets and camera systems. The USV will be supported by an electric ROV. Compared to a typical ROV, it is lighter, smaller and does not have a hydraulic fluid reservoir.

Table 2-6: Typical ROV specification

Specification	Typical Characteristics
Work class	150–200 horsepower (hp)

Specification	Typical Characteristics
Weight	2,450–4,400 kg
Footprint	up to 1.8 m by 3.5 m
Hydraulic control fluid tank	Up to 5 L

2.5 Installation activities

2.5.1 Underwater acoustic positioning

Installation of the subsea infrastructure (e.g. PLET, PLET foundations and spool) proximal to the end location of DPD (Point 1; refer to Table 2-2 for coordinates) requires accurate positioning on the seabed. Therefore, ultra short baseline (USBL) and/or long baseline (LBL) acoustic positioning may be required. These underwater acoustic positioning systems provide accuracy up to one metre. Typically, for USBL positioning, transponders are attached to subsea equipment and recovered once the equipment is correctly positioned on the seabed. For LBL, transponders are typically fixed to seabed frames, which are deployed and then fully recovered once the subsea equipment is correctly positioned.

After metrology, the units will be retrieved. Transponders will be active during calibration or positioning only. The operation duration is approximately 2 days for an array (expected to be one location); however the array may be put into sleep mode during its deployment and left in place for several weeks while the vessel undertakes other activities.

LBL and USBL systems work by emitting short pulses of medium- to high-frequency sound. Transmissions are not continuous but comprise short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds, typically at 19–33 kHz. Additional equipment associated with both systems that may be used include surface and subsea deployed beacons, transponders and receivers. Table 2-7 details the total temporary footprint for the LBL transponder frames.

2.5.2 Surveys

Surveys will be undertaken at various stages throughout the Activity with a duration of approximately 0.5 days per survey, dependent on the area to be surveyed.

Pre-lay surveys identify debris, seabed features (including potential underwater cultural heritage [UCH]) or obstructions along the DPD route. It is not a full geophysical survey. An allowance of up to 250 m on either side of the DPD route allows for localised rerouting if any significant obstructions and areas of spanning are identified during the pre-lay survey. Site surveys have already been undertaken for the DPD route and no debris was identified that would need to be removed before installation.

As-laid, post-lay and cathodic protection surveys will also be progressively undertaken throughout the Activity. The data from these surveys will be used to determine the DPD position once laid, inform free-span rectification and identify deviations from straightness. Post cyclone surveys may be performed along the Barossa DPD, including during the preservation period, subject to cyclone intensity. Surveys will use the same techniques as outlined above and may also include visual inspections using ROVs, and cathodic protection inspections using passive field gradient sensing equipment.

The survey methods are non-intrusive and the equipment does not disturb the seabed. Survey methods include MBES, SSS, sub-bottom profiler (SBP), ROV-mounted equipment (such as video, altimeter and obstacle avoidance sonar) and magnetometer.

MBES uses sound pulses to establish the seabed profile. Most modern MBES systems work by transmitting a broad acoustic pulse from a hull-, pole- or ROV-mounted transducer.

SBP determines the sea floor subsurface characteristics and composition using acoustics pulses transmitted from a towed surface or deep-sea source.

SSS detects debris and other obstructions on the sea floor using a towed transducer that transmits high-frequency acoustic pulses.

The magnetometer survey uses magnetic induction to identify the presence of iron (e.g. wrecks and unexploded ordnance) on the seabed from a towed surface or deep-sea source.

ROV-mounted obstacle avoidance sonar provides depth indications and object imaging to aid in navigation using sound waves. ROV-mounted altimeter measures an objects depth using depth or pressure sensors.

2.5.3 Supporting structures installation

2.5.3.1 PLET foundation and spool mattresses

The PLET foundation will provide long-term support for the PLET, and the coordinates are listed in Table 2-2. The PLET foundation is a steel structure (refer to Figure 2-5). The spool is supported on mattresses with scour protection (Section 2.5.3.3). The PLET foundation and spool mattresses will be installed using the construction vessel. The construction vessel crane will lift the PLET foundation and spool mattresses from the vessel deck onto the seabed. An ROV would be used during installation to position and orientate the supporting structures. The footprint for the PLET foundation and spool mattresses is listed in Table 2-7.

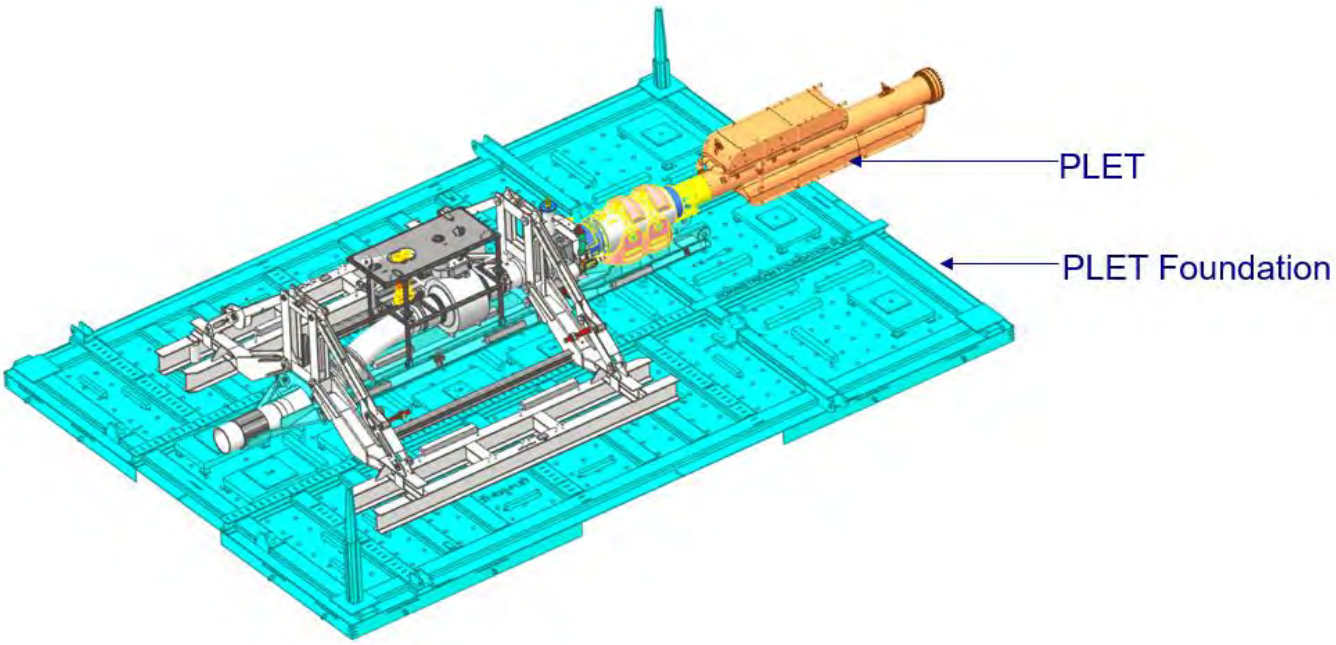


Figure 2-5: Example of PLET and PLET foundation configuration.

2.5.3.2 Scour protection and span rectification

Analysis of the DPD route (Atteris, 2023) identified no span locations—a further span analysis will be conducted from pre-lay and post-lay survey data and any spans will be rectified as required. In addition, span support may be required for the PLET foundation (Atteris, 2023). Scour protection structures are typically mattresses or grout filled bags. Supporting structures and installation techniques are outlined in Sections 2.5.3.3 and 2.5.3.4.

The footprint for the scour protection and an allowance for potential span rectification is listed in Table 2-7.

2.5.3.3 Supporting structures: concrete mattresses

Mattresses (Figure 2-6) will be installed to:

- support the spool
- provide scour protection and span rectification.

Concrete mattresses are blocks of dense material (typically concrete) bound together by flexible cables (usually artificial fibre ropes made from PP) (see Figure 2-6). Each concrete mattress is typically 6 m by 3 m with varying concrete block thickness—ranging from 0.3 m to 0.5 m—as determined by design.

A crane on the pipelay or construction vessel will lift concrete mattresses from the vessel deck and lower them to the seabed, and an ROV will position and orientate the concrete mattresses before they land on the seabed.

Figure 2-6: Example of a concrete mattress

2.5.3.4 Supporting structures: grout bags

Grout bags are commonly used to correct post-lay spans. Grout bags are made of flexible material (e.g. woven PP), which are filled with granular material such as sand (see Figure 2-7). A binder (typically cement) is included to stabilise the granular material within the bag. Grout bags can also come filled with rock without any binding material (depending on the size of the rock particles). Depending on the height of the span, small, prefilled grout bags may be installed individually by ROV or may be lowered slowly to the seabed by crane in bulker bags for individual placement.

Higher spans are rectified using post-filled grout bags. The empty grout bags are positioned under the pipe by ROV and are filled from the surface using a liquid slurry of grout via a downline. The downlines are flushed to subsea after each operation to ensure the grout does not set in the downline between filling operations. Typically, post-filled grout bags are pyramidal in shape and the footprint of each grout bag is up to approximately 5 m by 5 m, depending on span height. Depending on seabed conditions, scour protection may also be required to ensure the grout bags are not undermined; scour protection (such as a concrete mattress or an inflatable grout skirt) could extend nominally 3 m around the circumference of the grout bag.

Figure 2-7: Example of a grout bag

2.5.4 Infrastructure installation

2.5.4.1 Barossa DPD

The lay direction of the Barossa DPD is from the Commonwealth/NT waters boundary to the PLET.

The pipelay vessel will use a traditional s-lay installation method to install the DPD. Upon transfer of the linepipe to the vessel, the linepipe will be stored either on deck or below in deck holds. Each linepipe will be inspected to ensure it is free of debris and damage.

The DPD will be laid using a continuous assembly pipe-welding installation method, which involves the horizontal assembly of single pipe joints (approximately 12 m long) on the pipelay vessel's working plane. The pipe joints will be welded together, inspected, and coated before being lowered behind the pipelay vessel. As welding progresses, the DPD will be continuously lowered to the seabed, while the vessel slowly moves along the pre-determined DPD route. To maintain the DPD's curvature, the stinger, a steel structure with rollers extending from the end of the firing

line/vessel, will support the upper section of the DPD catenary. Tensioners and forward DP thrust will apply tension to the DPD to maintain the catenary and prevent the DPD from buckling as it is lowered to the seabed. The pipelay vessel will proceed at nominally 2 to 3 km per day and is expected to take up to approximately 14 days to complete the pipelay lay.

The seabed footprint associated with installing the Barossa DPD is provided in Table 2-7.

2.5.4.2 PLET

An example of a PLET is shown in Figure 2-5. The pipelay vessel will use a traditional s-lay installation method to install the PLET where PLET (excluding PLET foundation and PLET protection structure) will be lowered from the pipelay vessel deck into the firing line where it is then welded into the pipe string. PLET and DPD are progressively lowered to the seabed, as the vessel moves forwards, until PLET/DPD assembly is landed onto the pre-installed PLET foundation.

2.5.4.3 PLET protection structure

Following PLET installation (see Section 2.5.4.2), a PLET protection structure will be installed using the construction vessel. The PLET protection structure may be temporarily placed on the seabed or a temporary foundation to prevent the structure from embedding into the seabed (subject to operational constraints) and the temporary seabed footprint is listed in Table 2-7. Once in place, the PLET protection structure does not add to the seabed disturbance footprint generated by PLET foundation. Figure 2-8 illustrates an example of a PLET with PLET protection structure installed.

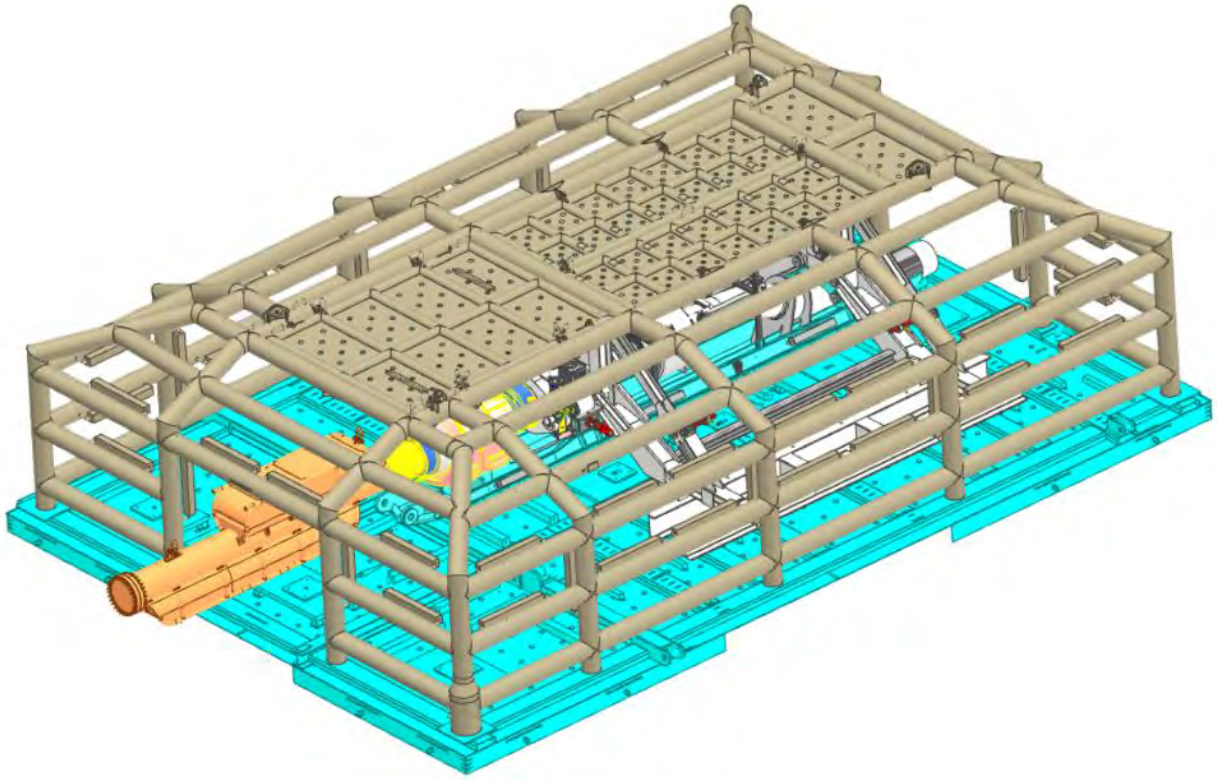


Figure 2-8: Example of PLET with protection structure

2.5.4.4 Spool

An example spool is shown in Figure 2-9. The spool will be installed to connect the PLET to the GEP PLET (Note: GEP PLET installation is out of scope for this EP). To facilitate spool installation, the existing GEP PLET protection structure will be removed from the GEP PLET and placed onto temporary foundations (such as mattresses, plates or blocks) adjacent to it, a process known as ‘wet parking’. The temporary foundations will prevent the PLET protection structure footings from embedding into the seabed. The spool will likely be installed free-flooding (raw sea water will enter the spool). The construction vessel will install the spool by lowering it onto pre-installed spool mattresses. Once the spool is positioned, the temporary caps will then be removed, and the spool connected to PLETs, then flushed with MEG. On completion of the spool pre-commissioning activities (flushing, leak testing etc), the PLET protection structure will be re-installed over the Barossa GEP PLET and the temporary foundations recovered.

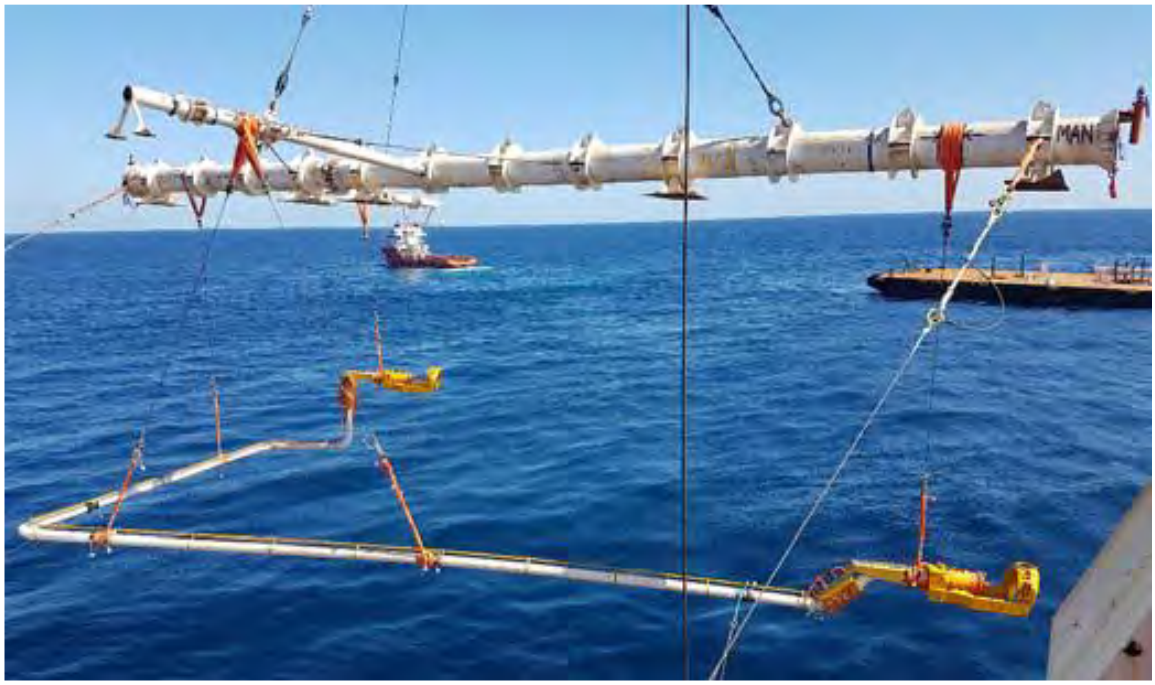


Figure 2-9: Example of spool

2.5.5 Bunkering

The pipelay and construction vessels and USV may require bunkering (refuelling). A support or supply vessel will transfer MDO (marine diesel oil) or MGO (marine gas oil) to the vessel using the ship-to-ship bunkering process. It is expected that approximately 2 bunkering events will occur for the construction and pipelay vessels during the Activity. The pipelay vessel is anticipated to bunker up to 700 m^3, with the construction vessel bunkering a maximum of 350 m^3. The USV is anticipated to require bunkering of up to 5 m^3 every 2 weeks whilst in the OA.

Helicopter operations may include offshore helicopter refuelling on the pipelay and construction vessel helidecks, subject to flight distances and weight of the loads the helicopter will be carrying.

2.5.6 Seabed footprint

The overall footprint from the Activity has been estimated by calculating the footprint of the seabed infrastructure and supporting structures described in the previous sections, as listed in Table 2-7.

Table 2-7: Estimated seabed footprint from subsea infrastructure

Infrastructure	Seabed footprint	Description
Supporting structure installation	0.10 ha	Includes PLET foundation, spool mattresses, PLET protection structure wet parking, span rectification and scour protection.
Infrastructure installation	1.87 ha	Includes permanent disturbance such as the installed DPD (calculated based on the length multiplied by the diameter of the pipeline [with corrosion coating included]). Includes temporary disturbance such as ROV and LBL transponder frames.
20% contingency	0.39 ha	To address potential footprint increase for structures and optimisation (subject to detailed design) as well as contingency span rectification / infrastructure repositioning / wet parking (if required).
Estimated total seabed footprint	**2.36 ha**	

2.6 Pre-commissioning activities

Once the DPD is installed, pre-commissioning activities (e.g. FCGT, dewatering and preconditioning; refer to Sections 2.6.1 and 2.6.2) will occur, then the spool will be installed. The spool will then be separately pre-commissioned (refer to Section 2.6.3). Pre-commissioning activities ensure the integrity and connections of the infrastructure. Pre-commissioning activities will be undertaken in accordance with the Company pre-commissioning

philosophy and project specific procedures to be developed by the successful pre-commissioning subcontractor and approved by Company.

Section 2.11 describes the chemical selection assessment process for the pre-commissioning fluids. The pre-commissioning fluids discharged to the sea include treated sea water and MEG.

Treated sea water is sea water conditioned with a hydrotest mixture. The hydrotest mixture is typically a mixture of biocides (to prevent biofouling on the internal surfaces), an oxygen scavenger and corrosion inhibitor (to control corrosion of the DPD) and a dye (allows for leaks to be detected through visual inspections). A dosage rate depends on the preservation period. The dosage rate is expected to be approximately 350 ppm (up to 550 ppm) using a product similar to Hydrosure or Roemex Hydro 3.

MEG will be discharged at a final purity of greater than 92%.

Table 2-8 lists the pre-commissioning activity discharge types and volumes.

2.6.1 Flood, clean, gauge and pressure testing (FCGT)

Once installed, the DPD internal surfaces need to be cleaned and inspected to determine if any unacceptable restrictions and/or obstructions exist in the DPD. This is conducted through pigging (a pig is a tool used to clean, gauge and inspect a pipeline). A series of pigs will be pushed through the DPD to clean the pipeline, gauge the pipeline and ensure all air is removed during the flooding process.

The pigs are pushed using treated sea water sourced from Darwin harbour.

In the flooding process, treated sea water will separate each pig in the train and will be discharged to sea as each pig completes a run. A slug of filtered and treated sea water will be injected ahead of the first pig to lubricate the sealing discs on the pig and to control pig speed. Some debris from DPD installation activities (typically sand and particulate debris) may remain within the DPD and this may be discharged with this treated sea water. Flooding treated sea water is expected to be discharged over approximately 8 hours at the PLET; the discharge volumes are listed in Table 2-8.

Once the pigging operations are completed and the condition of the gauge plates has been confirmed, the DPD will undergo a hydrostatic pressure test (hydrotest) using treated sea water to pressurise the DPD. The hydrotest pressure will be held for a period (as per the relevant standard) to test the DPD integrity. Small, localised discharges will occur around the PLET as that infrastructure is tested and the DPD is depressurised. Hydrotest depressurising treated sea water is expected to be discharged over approximately 4 to 6 hours at the PLET; the discharge volumes are listed in Table 2-8.

2.6.2 Dewatering and pre-conditioning

On completion of FCGT, the flooded DPD will be dewatered, conditioned with MEG and filled with nitrogen for preservation until commissioning. The DPD will be dewatered using a train of dewatering pigs separated by MEG slugs, driven by nitrogen injected from onshore. Discharge of the treated sea water will take up to 6 days through a diffuser at the PLET, followed by approximately 1 hour of MEG discharge and vented nitrogen. The discharge volumes are listed in Table 2-8.

On completion of the dewatering and preconditioning activities, the DPD will be packed with nitrogen until commissioning to ensure the integrity of the infrastructure is maintained.

2.6.3 Spool leak testing and MEG flushing

The tie-in spool between PLET and GEP PLET (Note: GEP PLET installation is out of scope for this EP) will be installed free flooding. Once tied in, the raw sea water will be displaced using treated MEG, injected at one PLET then discharged at the other PLET prior to performing a leak test. The leak test pressure will be held for a period (as per the relevant standard) to test the connection integrity. Small, localised discharges will occur as that infrastructure is tested and depressurised. Leak test depressurising MEG is expected to be discharged over approximately one hour. Table 2-8 lists the nominal MEG discharge volumes.

2.7 Contingency activities

2.7.1 Wet buckle contingency

A wet buckle is a failure during the DPD installation resulting in untreated (raw) sea water entering the DPD due to buckled or damaged lines. In the event that the damaged section of the DPD cannot be recovered over the pipelay vessel stinger, then the following activities—undertaken by ROV (or divers, if required)—will be undertaken:

- the DPD will be laid down

- seabed rectification (e.g. jetting) to provide adequate access to the DPD section to position and manoeuvre the cutting device, such as a diamond wire cutting system, if required
- clamping then cutting the DPD to remove the damaged section
- temporary wet parking (if required) and removal of the discarded DPD section using a pipeline recovery tool.

If this occurs, the untreated sea water must be removed from the DPD. The DPD may also need to be flushed with treated sea water, depending on the cause of the wet buckle and the activities that must be performed before pipeline lay activities can safely recommence.

If a wet buckle occurs, a detailed incident investigation will be conducted and any findings satisfactorily addressed before pipelay activities can recommence. If modifications are required to the pipelay vessel or procedures that result in an extended period (typically 30 days or more) before pipelay can recommence, then the DPD will be flooded with treated sea water to safely preserve it until pipelay recommences. In this instance, the sea water will be treated with the same chemicals used for FCGT, as described in Section 2.6**,** and the DPD will need to be dewatered immediately before pipelay restarts to allow the DPD to be recovered to the surface.

The DPD does not need to be temporarily preserved if pipelay activities can safely be recommenced in a timely manner, typically less than 30 days from the introduction of untreated sea water into the DPD. In this instance, the untreated sea water must be displaced using a series of bidirectional pigs and then pipelay activities can recommence. Once the pipelay is completed, FCGT activities will be conducted as detailed in Section 2.6.1.

2.7.2 Stuck pig contingency

If a pig gets stuck or damaged in the DPD during pre-commissioning, it will be forced out using a high seal pig, or a train of high seal pigs, resulting in a discharge at the PLET. If the stuck pig occurs during flooding, then the high seal pig(s) will be propelled with filtered and treated sea water to the same specification as the flooding train. If the stuck pig occurs during dewatering, then the high seal pigs may be separated by MEG and will be propelled with nitrogen. The process for propelling the high seal pigs and the associated discharges at the PLET will be similar to the processes outlined in Sections 2.6.1 and 2.6.2, and discharge volumes listed in Table 2-8. In the unlikely event of a stuck pig, the timing between discharges associated with the planned pre-commissioning activity and the contingency stuck pig activities shall be a week or more, as such there are no cumulative impacts as a result of the discharges.

2.7.3 Inspection, maintenance and repairs

IMR activities for the subsea infrastructure are not planned to occur. However, unplanned IMR activities of the infrastructure or supporting structures may be required during the Activity (including the preservation period; see Section 2.8) due to unplanned events (e.g. unstable seabed conditions, significant earthquake, major cyclone events, anchor strike, dropped objects, and trawl gear interference) that could physically damage and affect the integrity of the infrastructure, possibly triggering the requirement for an inspection. IMR activities are typically undertaken from a vessel equipped with ROVs with transponders, supported by supply vessels, ROVs and divers (if required). These unplanned events are not expected to occur; however, they are included in this EP in the very unlikely event that they are required.

Inspection activities (such as cathodic protection surveys, MBES and general visual inspections) may occur on infrastructure.

Typical maintenance and repairs undertaken include:

- cathodic protection system maintenance, including anode replacement
- infrastructure repairs and servicing (including leak testing)
- restabilisation
- marine growth removal
- fishing nets or other marine debris removal
- recommissioning.

In the unlikely event of DPD failure, intervention on the DPD may be required. This may entail fitting a pipeline clamp or pressure retaining sleeve over the site of the damage, seabed rectification, span correction, underwater cutting, wet parking, removal of a DPD section and subsequent tie-in using a replacement section. This may result in DPD intervention and pre-commissioning activities using similar approaches to those detailed in Section 2.7.1 and Section 2.6 respectively.

2.8 Preservation period

The preservation period maintains the integrity of the subsea infrastructure after the infrastructure has been installed and pre-commissioned. The preservation period commences on the completion of the pre-commissioning activities covered under this EP (See Section 2.6) until the commencement of activities under the Barossa Production Operations EP (see Section 2.3 for estimated duration).

The preservation period activities include:

- unplanned IMR activities, if required (see Section 2.7.3)
- non-production period, involving wet-parking or leaving the installed and pre-commissioned infrastructure (covered under this EP) in-situ.

2.9 Summary of discharges and emissions

Table 2-8 lists the discharge and release types, and volumes for the Activity. Section 2.6 details the chemicals, composition dosage rates and dilution ranges for the treated sea water and MEG. The chemicals selected were assessed using a risk-based approach described in Section 2.11.

Table 2-9 summarises a typical vessel, equipment and helicopter emissions and discharges.

Table 2-8: Summary of planned activity discharges

Activity	Discharge type	Approximate volume (m^3)
Flooding	Treated sea water	5,650
Hydrotest depressurising	Treated sea water	2,000
Dewatering	Treated sea water	50,120
Pre-conditioning	MEG	1,000
Spool flushing and leak testing	MEG	225
Grout downline flushing (contingency)	Grout	4

Table 2-9: Summary of typical vessel, equipment and helicopter emissions and discharges

Type	Description
Emissions	
Atmospheric emissions (hydrocarbon combustion)	• activity vessel engines and associated equipment engines and helicopters • operation of vessel incinerators
Noise emissions	• vessel activities (e.g. vessel engines, DP thrusters and other machinery) • acoustic positioning systems • ROV activities • helicopter activities
Light emissions	• vessel navigation and safety lighting • spot lighting as needed • ROV underwater lighting
Discharges	
Ballast water	Ballast water could potentially be discharged to the marine environment from vessel ballast tanks.
Sewage and greywater	The volume of sewage and greywater directly relates to the POB number[3]. Up to 30–40 L of sewage/greywater may be generated per person per day. The estimated maximum sewage and greywater discharged is approximately 22,080 L/day.

[3] *For this Activity, the maximum POB within the OA is 552. This estimate assumes the pipelay (270 POB), construction (250 POB) and 2 supply (32 POB combined) vessels are in the OA concurrently.*

Type	Description
Deck drainage/run-off	Drainage water from activity vessels includes rainwater, sea water and washdown water. Such discharge may potentially contain small residual quantities of oil, grease and detergents if present or used on the decks. During an unplanned fire event, firefighting foam may also be present.
Cooling water	Excess heat in the cooling water will be carried away from vessel and equipment components using sea water and returned to the sea with residual sodium hypochlorite.
Bilge water	Oily bilge water will be treated via an oily water filter system to achieve no more than 15 mg/L oil in water after treatment, then discharged.
Brine (if a reverse osmosis unit is used for water treatment)	Brine generated from the water supply systems on the vessels will be discharged to the ocean at a salinity of approximately 10% higher than sea water.
Putrescible food waste effluent	Putrescible waste discharge to sea is estimated to be approximately 1 L of food waste per person per day. The estimated maximum food waste discharged is approximately 552 L/day.

2.10 Future decommissioning of DPD infrastructure

With the exception of any temporary equipment that will be removed from the OA at the end of the Activity under this EP, all infrastructure to be installed under this EP is planned to be fully utilised over the lifecycle of the Barossa Gas Project, which is expected to be approximately 25 years. While no Activity infrastructure is planned to be decommissioned as part of this EP, all infrastructure to be installed has been selected and designed to allow for removal when no longer used or to be used, as per requirements of Section 572 of the OPGGS Act.

An example of infrastructure selection and design to enable full removal decommissioning includes incorporating reversible features, such as a pre-installed tooling or connection system on key components. For example, the PLET protection structure is designed as an open frame structure with pre-installed tooling (e.g. lifting arrangements) to facilitate future removal requirements (see Figure 2-10).

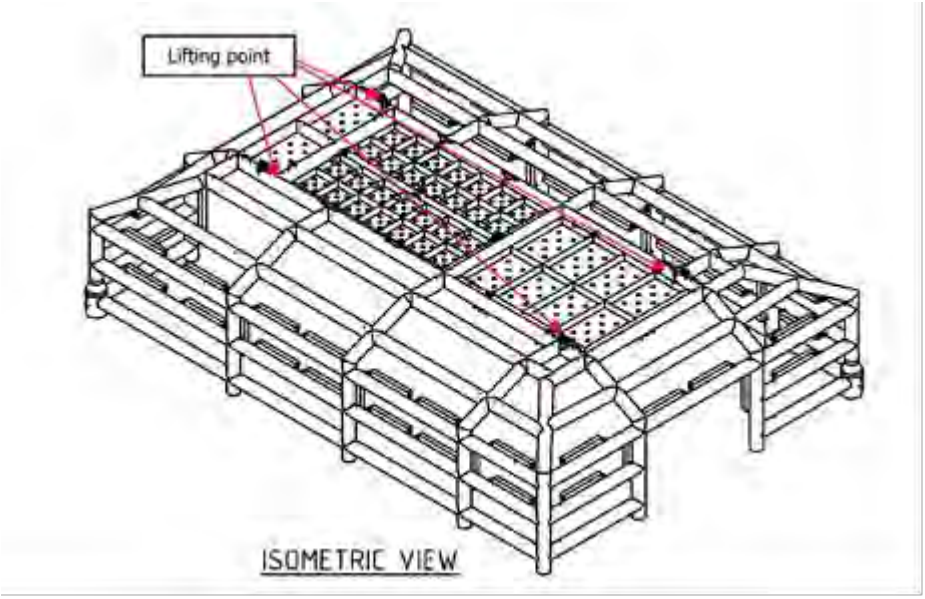


Figure 2-10: PLET protection structure lifting arrangements

Santos' contractor(s) must also maintain a comprehensive inventory of equipment and infrastructure including the precise installation locations. This will ensure that data such as the serial or identification numbers of Activity infrastructure is recorded during installation. The exact location of all subsea infrastructure and structures will be confirmed as part of the as-constructed survey process. This process will create records that will be used to plan for the future decommissioning of the Barossa Gas Project infrastructure.

As part of Santos' assets life cycle management requirements, decommissioning execution strategies will be matured throughout the life of the project. Santos' decommissioning strategy is to manage all equipment over the life cycle of the Activity to facilitate removal at the time of decommissioning through appropriate design, inspection and maintenance practices. Any potential derogations will be subject to approval under the OPGGS Act.

The ongoing inspection and maintenance of infrastructure and equipment, as well as decommissioning and removal of property with no further use prior to end of field life, will be addressed under the future Barossa Production Operations EP (currently under development).

The future Decommissioning EP will meet the requirements of the OPGGS Act and OPGGS(E)R, and any additional relevant legislation, policies (such as Policy: Section 572 Maintenance and removal of property [NOPSEMA, 2022]), guidelines (such as the Offshore Petroleum Decommissioning Guideline [DISER, 2022]) or papers (such as Planning for Proactive Decommissioning [NOPSMA, 2021]) in force at the time.

2.11 Chemical assessment

A risk-based approach to select chemical products ranked under the Offshore Chemical Notification Scheme (OCNS) is applied to those chemicals used and discharged or where there is a risk of discharge to the marine environment. This scheme lists and ranks all chemicals used in the exploration, exploitation, and associated offshore processing of petroleum on the United Kingdom's (UK) Continental Shelf. Chemicals are ranked according to their calculated hazard quotients (HQ) by the Chemical Hazard Assessment and Risk Management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data (CHARM Implementation Network, 2005). The HQ is converted to a colour banding—gold and silver colour bands represent the least environmentally hazardous chemicals (Table 2-10).

Table 2-10: OCNS chemical hazard and risk management hazard quotient and ranking

Minimum HQ value	Maximum HQ value	Colour banding	Hazard
>0	<1	Gold	Lowest
≥1	<30	Silver	
≥30	<100	White	
≥100	<300	Blue	
≥300	<1,000	Orange	
≥1,000		Purple	Highest

Chemicals not amenable to the CHARM model (i.e. inorganic substances, hydraulic fluids or chemicals used only in pipelines) are assigned an OCNS grouping based on the worst-case ecotoxicity data—Group E and D represent the least hazard potential (Table 2-11).

Table 2-11: Initial OCNS grouping

Initial grouping	A	B	C	D	E
Result for aquatic-toxicity data (ppm)	<1	≥1–10	≥10–100	≥100–1,000	>1,000
Result for sediment-toxicity data (ppm)	<10	≥10–100	≥100–1,000	≥1,000–10,000	≥10,000

Note: Aquatic toxicity refers to the Skeletonema costatum *EC_{50},* Acartia tonsa *LC_{50}, and* Scophthalmus maximus *(juvenile turbot) LC_{50} toxicity tests. Sediment toxicity refers to the* Corophium volutator *LC_{50} test.*

Source: Centre for Environment, Fisheries and Aquaculture Science (CEFAS), 2022

Subsea chemicals accepted are CHARM ranked gold/silver, or non-CHARM ranked Group E/D chemicals for use and discharge without a detailed environmental risk assessment. The same applies to chemicals that are on the PLONOR List. The PLONOR List, agreed upon by the OSPAR Convention (Oslo–Paris Convention for the Protection of the Marine Environment of the North-East Atlantic), contains a list of substances that pose little or no risk (PLONOR) to the environment in offshore waters. If chemicals are ranked lower than gold, silver, Group E or D (i.e. CHARM ranked purple, orange, blue or white, or non-CHARM Group A, B or C ranked chemicals) and no alternatives are available, the chemical is assigned a pseudo-ranking based on the available aquatic toxicity, biodegradation and bioaccumulation data (see Sections 2.11.1 to 2.11.3). A risk assessment is conducted to provide technical justification for their use and to show that their use and assessed for environmental acceptability for discharge to the marine environment.

2.11.1 Ecotoxicity Assessment

Table 2-11 and Table 2-12 provide guidance for assessing the ecotoxicity of chemicals when investigating potential alternatives. Table 2-11 is used by CEFAS to group a chemical based on ecotoxicity results, with 'A' representing the highest toxicity/risk to environment and 'E' the lowest risk. Table 2-12 shows classifications/categories of toxicity against aquatic toxicity results.

Table 2-12: Aquatic species toxicity grouping

Category	Species	LC_{50} and EC_{50} criteria
Acute 1 Hazard statement – Very toxic to aquatic life	Fish	LC_{50} (96hr) of ≤1 mg/L
	Crustacea	ELC_{50} (96hr) of ≤1 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96hr) of ≤1 mg/L
Acute 2 Hazard statement – Toxic to aquatic life	Fish	LC_{50} (96hr) of >1 mg/L to ≤10 mg/L
	Crustacea	EC_{50} (48hr) of >1 mg/L to ≤10 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96hr) of >1 mg/L to ≤10 mg/L
Acute 3 Hazard statement – Harmful to aquatic life	Fish	LC_{50} (96hr) of >10 mg/L to ≤100 mg/L
	Crustacea	EC_{50} (48hr) of >10 mg/L to ≤100 mg/L
	Algae / other aquatic plant species	ErC_{50} (72 or 96hr) of >10 mg/L to ≤100 mg/L

Source: United Nations (2021)

2.11.2 Biodegradation assessment

The biodegradation of chemicals is assessed using the CEFAS biodegradation criteria, which aligns with the categorisation outlined in the Globally Harmonized System Annex 9 Guidance on Hazards to the Aquatic Environment (United Nations, 2021). The below is used as a guide when investigating potential chemical alternatives. Preference is to select readily biodegradable chemicals. CEFAS categorises biodegradation into these groups:

- Readily biodegradable: results of >X% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol.
- Moderately biodegradable: results >20% and less than X% to an OSPAR HOCNF accepted ready biodegradation protocol.
- Poorly biodegradable: results from OSPAR HOCNF accepted ready biodegradation protocol.

where X is equal to:

- 60% in 28 days (OECD 306, Marine BODIS (biodegradability in sea water) or any other acceptable marine protocols, or in the absence of valid results for such tests)
- 60% in 28 days (OECD 301B, 301C, 301D, 301F, Freshwater BODIS); or
- 70% in 28 days (OECD 301A, 301E).

2.11.3 Bioaccumulation assessment

The bioaccumulation of chemicals is assessed using the CEFAS bioaccumulation criteria, which aligns with the categorisation outlined in the Globally Harmonized System Annex 9 Guidance on Hazards to the Aquatic Environment (United Nations, 2021). Preference is to select chemicals that are not bioaccumulative.

The following guidance is used by CEFAS:

- Non-bioaccumulative/non-bioaccumulating: Log Pow <3, or results from a bioaccumulation test (preferably using *Mytilus edulis*) demonstrate a satisfactory rate of uptake and depuration, and the molecular mass is greater than or equal to 700.
- Bioaccumulative/bioaccumulates: Log Pow ≥3, or results from a bioaccumulation test (preferably using *Mytilus edulis*) demonstrate an unsatisfactory rate of uptake and depuration, and the molecular mass is less than 700.

Santos will use chemical products considered to be ALARP following the risk assessment.

3. Description of the environment

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Description of the environment (2) The environment plan must: a. describe the existing environment that may be affected by the activity; and b. include details of the relevant values and sensitivities (if any) of that environment. *Note: definition of **environment** in section 5 includes its social, economic and cultural features.* (3) Without limiting paragraph (2)(b), relevant values and sensitivities may include any of the following: a. the world heritage values of a declared World Heritage property; b. the National Heritage values of a National Heritage place; c. the ecological character of a declared Ramsar wetland; d. the presence of a listed threatened species or listed threatened ecological community; e. the presence of a listed migratory species; f. any values and sensitivities that exist in, or in relation to, part or all of: i. a Commonwealth marine area; or ii. Commonwealth land.

3.1 Environment that may be affected (EMBA)

This section describes the key physical, biological, socioeconomic and cultural features (values and sensitivities) of the existing environment that may be affected by the Activity. The description of the environment applies to the OA (Section 2.3), and any areas surrounding the OA that may be affected by the Activity. In this EP the area that may be affected by the impacts and risks of the Activity is described as the environment that may be affected (EMBA), or in the case of a hydrocarbon spill, low exposure value area (LEVA) (which also defines the modelled EMBA) and moderate exposure value area (MEVA). The low and moderate exposure values are listed in Table 3-1 and shown in Figure 3-1.

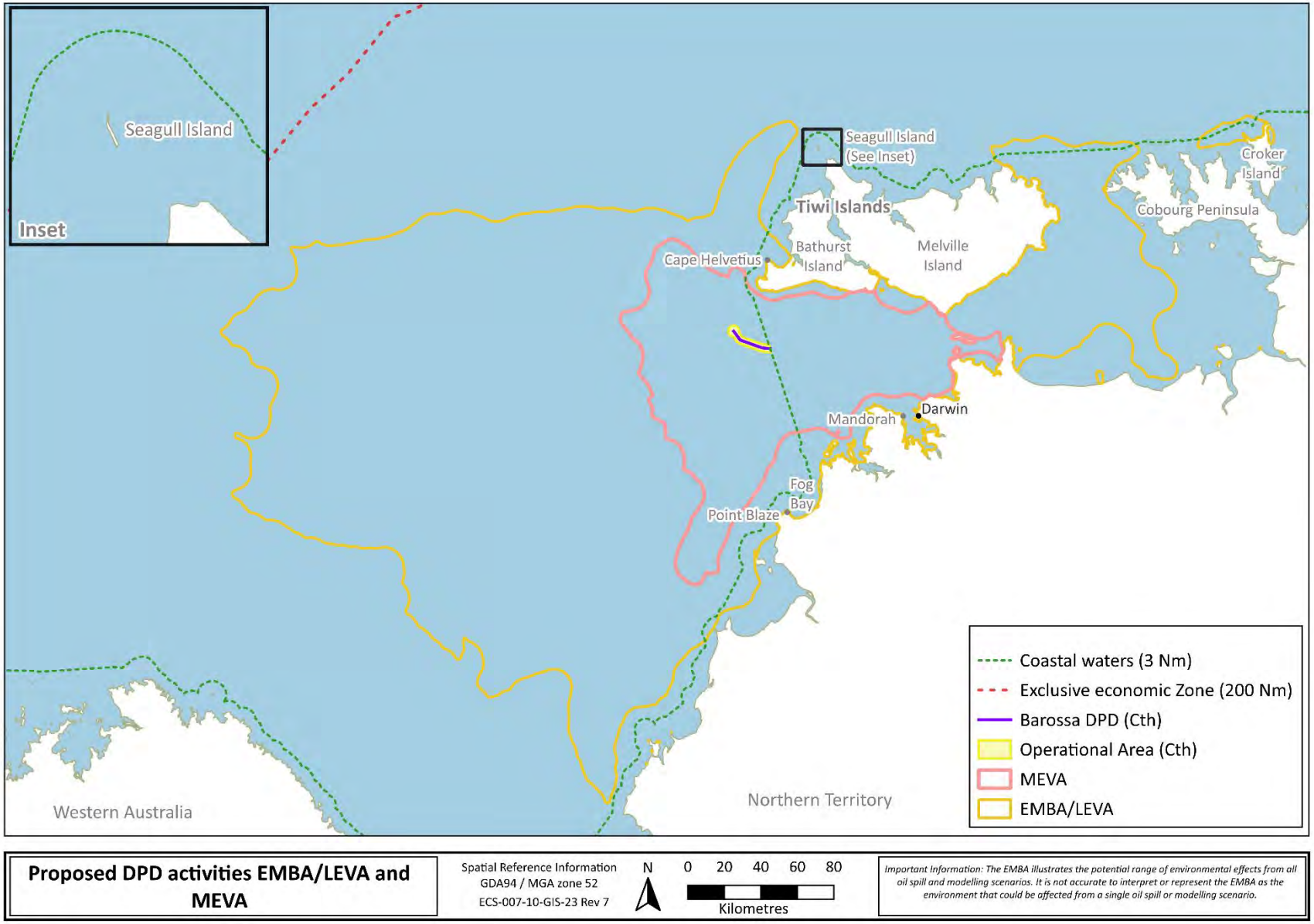


Figure 3-1: Location and extent of the EMBA/LEVA and MEVA

3.1.1 Determining the EMBA

Stochastic hydrocarbon dispersion and fate modelling is applied to the worst-case spill scenario for the Activity to inform the EMBA (in this case also the LEVA) and the MEVA. Areas potentially contacted by hydrocarbons were determined using stochastic modelling which overlayed hundreds of individual hypothetical spill simulations from a hydrocarbon spill into a single map, with each simulation subject to a different set of metocean conditions drawn from historical records. Stochastic modelling compensates for the uncertainty associated with any single hydrocarbon spill event such that risk assessment and spill response planning are more robust and conservative by covering a wide range of possible scenarios.

Modelling considers key physical and chemical phases of hydrocarbons that pose differing environmental and socioeconomic risks, being surface, entrained, dissolved aromatic and shoreline accumulated hydrocarbons. Defining the areas that may be contacted by spilled hydrocarbons depends on the concentrations of the hydrocarbons on the sea surface, in the water column and on the shoreline.

Hydrocarbon exposure threshold values defined by NOPSEMA (2019) for each of these phases were applied to the stochastic modelling outputs to determine the areas affected by the MEVA and the LEVA. The MEVA represents an area wherein contact with hydrocarbons may result in harmful impacts to biota, encompassing the maximum extent of biological impact. The LEVA represents the maximum extent of possible contact with hydrocarbons within the depth range between 0–10 m and reflects the range of socioeconomic considerations for spill response planning and scientific monitoring. For this reason, the LEVA has been used to define the modelled EMBA. Importantly, in terms of impacts to environmental values and sensitivities, the extent of a particular impact and risk may not be relevant to the full extent of the modelled EMBA, therefore, the MEVA is also referred to where relevant in this EP.

The worst-case release scenario identified as relevant to the Activity (see Section 7.6) is considered to be a release of up to 559 m^3 of MDO caused by a vessel collision[4] rupturing a vessel fuel tank, as this represented the largest spatial extent of potential changes to ambient environment conditions. The MEVA and EMBA are shown in Figure 3-1 and exposure values are provided in Table 3-1. Further information about the reasons why these exposure values have been selected and how their application in defining areas relates to impact and risk assessment and spill response planning is provided in Table 7-9, Table 7-10 and Section 7.6.

It is important to note that the footprint of an actual spill event is more accurately represented by only one of the simulations from the stochastic modelling, resulting in a much smaller spatial footprint in the event of an actual spill. Modelling of a single simulation, representative of a single spill event, is termed deterministic modelling. This is discussed further in Section 7.6.2.2 and applied in the risk assessment where relevant.

Table 3-1: Hydrocarbon exposure values (NOPSEMA, 2019)

Hydrocarbon phase	Exposure value		
	Low	Moderate	High
Surface (g/m^2)	1	10	50
Shoreline accumulation (g/m^2)	10	100	1,000
Dissolved aromatics (ppb)	10	50	400
Entrained (ppb)	10	n/a	100

3.2 Existing Environment

This section summarises the existing environment that may be affected by the Activity and includes details of the particular values and sensitivities pertaining to the EMBA. A detailed description of the values and sensitivities of the EP was informed by EPBC Act protected matters reports (Appendix D), stated values in the Marine Bioregional Plans for the North Marine Region (NMR) and the North-West Marine Region (NWMR) (CoA, 2012a,b), Barossa environmental studies (Section 3.2.1.2), publicly available information (such as scientific literature, studies and government databases) and information obtained through consultation. Marine and coastal species identified in the protected matters report (Appendix D) are described, with a focus on protected species that are threatened and migratory. It is important to note that this document describes the environmental values and sensitivities that occur within the boundaries of the EMBA, whereas the PMST incorporates an in-built buffer and hence may report on matters that are outside the EMBA.

[4] The maximum credible spill volume is 559 m^3 of MDO from a vessel collision resulting in a fuel tank rupture. Santos had previously modelled a 700 m^3 spill volume. Instead of re-modelling the smaller spill volume of 559 m^3, this EP will present modelling data based on a 700 m^3 spill volume for the spill collision analysis. This approach is considered conservative.

Review of the available information identified a range of environmental receptors, values and sensitivities within the OA and the wider EMBA that have been further researched and are described within this section.

For the purposes of the environmental assessment, identifying potential environmental consequences and developing spill response plans, the environmental values captured by the moderate hydrocarbon exposure threshold values defined by NOPSEMA (2019), representing the thresholds whereby harmful impacts to biota may result, are also identified within the area referred to as the MEVA in this section. More information about the reasons why these exposure values have been included and how their application in defining areas relates to impact and risk assessment and spill response planning is provided in Table 7-9, Table 7-10 and Section 7.6.

3.2.1 Geographical extent

The OA is located within Commonwealth waters, approximately 95 km north-west of Darwin, NT, approximately 25 km south-west of the Tiwi Islands, NT and approximately 44 km south-east of the Oceanic Shoals Marine Park. The OA is located within the NMR, which encompasses approximately 625,689 km^2 of Commonwealth waters from west Cape York Peninsula (Queensland) to the NT/Western Australian (WA) border (CoA, 2008; CoA, 2012a) (Figure 3-2).

The EMBA (based on low exposure values) intersects Commonwealth waters—including the NMR (CoA, 2012a) and the NWMR (CoA, 2012b)—and NT waters. The MEVA intersects Commonwealth waters—including the NMR—and NT waters.

A summary of the key characteristics of the NMR relevant to the EMBA include (CoA, 2012a):

- a wide continental shelf, with water depths averaging less than 70 m and ranging from approximately 10 m to a maximum known depth of 357 m
- currents driven predominantly by strong winds and tides, a monsoonal climate and complex weather patterns
- limestone pinnacles, which forms part of a key ecological feature (KEF)—Pinnacles of the Bonaparte Basin (Section 3.2.11.4), valued for hard substrate in an otherwise soft sediment environment and so are important for sessile species
- banks, ridges and terraces of the Van Diemen rise, which forms part of a KEF—Carbonate bank and terrace system of the Van Diemen Rise, valued for enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity
- cultural features including sea country (Section 3.2.14).

The key characteristics of the NWMR relevant to the EMBA include (CoA, 2012b):

- the Indonesian Throughflow, a low-salinity water mass that is one of the major elements of the global transfer of heat and water between oceans and which plays a key role in initiating the Leeuwin Current
- a chain of carbonate banks and shoals, which forms part of a KEF—Carbonate bank and terrace system of the Sahul Shelf (Section 3.2.11.4), valued for enhancing biodiversity and local productivity relative to their surrounds
- limestone pinnacles, which forms part of a KEF—Pinnacles of the Bonaparte Basin (Section 3.2.11.4), valued for hard substrate in an otherwise soft sediment environment and so are important for sessile species
- cultural features including sea country (Section 3.2.14).

3.2.1.1 Provincial Bioregions

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA; Department of the Environment and Heritage [DoEH], 2006), the bioregions relevant to the OA and the EMBA (LEVA) are listed in Table 3-2 and shown in Figure 3-2. The Northern Shelf Province is characterised as a gently sloping shelf, topped with a number of pinnacles at depths ranging from 5 m to 30 m and tidal eddies (CoA, 2012a). Northwest Shelf Transition is characterised by a shelf break and continental slope (CoA, 2012b).

Table 3-2: IMCRA provincial bioregions within the OA, MEVA and EMBA

Bioregion	OA	MEVA	EMBA
Northern Shelf Province	✗	✗	✓
Northwest Shelf Transition	✗	✓	✓

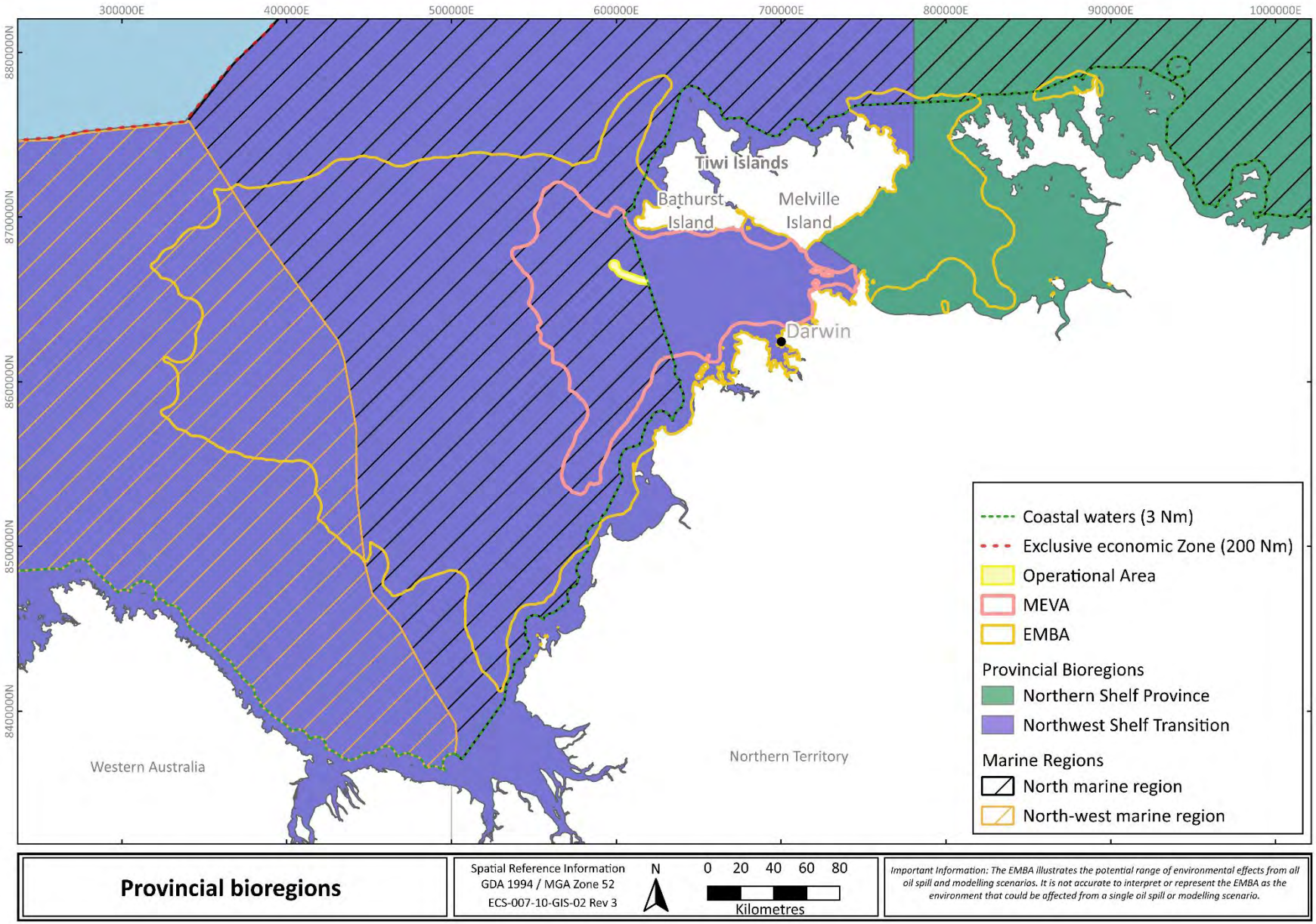


Figure 3-2: IMCRA provincial bioregions in relation to the EMBA

3.2.1.2 Barossa marine studies program and additional studies

Extensive environmental and socioeconomic studies have been undertaken to characterise the existing environment. Table 3-3 summarises the Barossa marine studies program which involved the collection of detailed baseline data from July 2014 to July 2015 to capture seasonal variability in the region, as well as supplementary surveys and desktop modelling studies to contribute to the understanding of the baseline environment. Santos refers to this description as information previously given under section 56(1) of the OPGGS(E) Regulations. Further detail and copies of the earlier studies are provided in Section 5, Appendix C and Appendix D of the OPP (ConocoPhillips, 2018) as information previously given under section 56(1) of the OPGGS(E) Regulations.

Table 3-4 summarises the additional relevant Barossa initiated environmental, socioeconomic and cultural features studies undertaken to inform the understanding of the environment (including socioeconomic and cultural features) after the initial Barossa marine studies program including those done specifically for this EP.

Table 3-3: Summary of the Barossa marine studies

Study type	Description of study	Reference
Field-based studies		
Metocean data collection	Collection of metocean data on the surface and through the water column from July 2014 to March 2015, within and near the Barossa field, e.g., current, conductivity, wave and wind data.	Fugro, 2015
Water quality survey	Collection of baseline data on physical and chemical components of water quality near the Barossa field. The surveys were completed in June 2014, January 2015 and April 2015.	Jacobs, 2015a, 2015b, 2015c, 2016a
Sediment quality and infauna survey	Collection of baseline data on sediment quality and infauna communities near the Barossa Development.	Jacobs, 2015c
Underwater noise survey	Collection of baseline data on ambient underwater noise (physical, biological and anthropogenic sources) at 3 locations from July 2014 to July 2015 near the Barossa Development and surrounding areas.	JASCO, 2015
Benthic habitat survey	Collection of baseline data to characterise topographic features, benthic habitats and macrofaunal communities near the Barossa field location and surrounding areas, including around Evans Shoal, Tassie Shoal and Lynedoch Bank by using a specialised ROV.	Jacobs, 2016
Desktop or modelling studies		
Environmental literature review and gap analysis	Collection and collation of publicly available information about the marine environment near the Barossa field, and gap analysis were performed to determine if sufficient information was available to inform an environmental impact assessment and any future regulatory approvals for a potential full field development.	Jacobs SKM, 2014
Hydrodynamic model validation study	Data from both the metocean study and deployment of drifter buoys near the Barossa field and surrounding areas were used to validate the underlying hydrodynamic model utilised to develop the spill and discharge models.	RPS APASA, 2017

Table 3-4: Summary of Barossa additional studies

Study type	Description of study	Reference
Geophysical survey	This was a preliminary geophysical survey of potential pipeline routes within the pipeline route corridor presented in the OPP (ConocoPhillips, 2019).	Fugro, 2016
Shoals and shelf survey 2015: benthic habitats and fish communities	A seabed biodiversity survey of 3 shoals to the west of the Barossa field (Evans Shoal, Tassie Shoal and Blackwood Shoal) and 2 mid-continental shelf regions relevant to the pipeline route corridor. The Australian Institute of Marine Science (AIMS) performed the survey in September/October 2015, which involved characterisation of the seabed habitats, associated biota and fish communities (shoals only).	Heyward et al., 2017
Oceanic Shoals Marine Park benthic habitat and fish diversity assessment	An AIMS seabed and fish biodiversity survey conducted in September and October 2017. The survey focused on 6 key sites inside and outside of the Oceanic Shoals Marine Park, including in the Habitat Protection Zone, and Shepparton Shoal. The objective was to use this new data to update the predictive habitat model and statistically compare the proportion and spatial diversity of habitats within and outside the Oceanic Shoals Marine Park.	Radford et al., 2019

Study type	Description of study	Reference
Tiwi Islands sensitivity mapping study	Collection of data on environmental, social, cultural and economic sensitivities for the Tiwi Islands. A desktop review of available data (spatial datasets) was followed by workshops with Traditional Owners to identify cultural and environmental sensitivities along the coast of the Tiwi Islands.	Jacobs, 2019
Maritime heritage assessment	A maritime archaeological assessment along the DPD route to identify potential maritime archaeological sites which are defined as wrecks (ship or aircraft) and associated material, dumped material, maritime infrastructure, and associated deposits on or under the seabed below the highest astronomical tide.	Cosmos Archaeology, 2022
Barossa pipelay light modelling	Light modelling assessment of the proposed pipelay and construction vessels, including cumulative impacts to predict the potential light impacts to turtle nesting habitat on the Tiwi Islands and hatchling behaviours.	Pendoley, 2022
Barossa pipelay Darwin Harbour lighting technical note	Desktop assessment of presence and significance of marine turtle nesting activity on beaches surrounding Darwin Harbour and likely level of impact from activity vessel lighting to flatback turtles.	Pendoley, 2022a
Benthic survey for Barossa DPD route	Collection of baseline information on the benthic habitats, sediment composition (including contaminant concentrations), macroinvertebrate (infaunal) assemblages, and water quality along the DPD route.	RPS, 2023b
Desktop study Tiwi turtle programs	This desktop report reviewed publicly available literature and research relating to marine turtle activity occurring on, and around, the Tiwi Islands. A total of 19 satellite telemetry studies between 1994-2023 tracked turtles passing through or foraging in waters near the Tiwi Islands.	Pendoley, 2023
First Nations UCH places along the GEP route	Assessment to identify any First Nations UCH places along the GEP route.	Corrigan, 2023
First Nations spiritual and cultural values in relation to the Darwin Pipeline Duplication Project	This report reviewed available ethnographic, linguistic, and historical materials and consultations and interviews held with key First Nations persons and others identified as having cultural and spiritual knowledge and authority associated with the study area. The report identified and mapped First Nations spiritual and cultural values relevant to the DPD Project.	Corrigan, 2024
First Nations archaeological desktop assessment in relation to the Darwin Pipeline Duplication Project	This study was a First Nations archaeological assessment for the submerged DPD Project Area based on a detailed geomorphological assessment. This study focused on the likelihood for deposits associated with the Last Glacial Maximum (LGM) to be impacted by the DPD Project.	OzArk, 2024

3.2.2 Physical environment

3.2.2.1 Geomorphology

3.2.2.1.1 Formation history

Around 550 to 160 million years ago, the northern and western parts of Australia formed part of the northern margin of Gondwana. Around 300 million years ago, crustal stretching, rifting and breakup initiated development of an extensive basin where sediments were deposited (Baker et al., 2008 in DEWHA, 2008a). About 135 million years ago the continent broke up, resulting in the separation of greater India and Australia.

3.2.2.1.2 Bathymetry and seabed

Generally, the EMBA consists of a wide continental shelf with several KEFs present (Section 3.2.11.4). Water depths within the majority (~80%) of the EMBA range between 0 and 100 m, with a trench approximately 100 km wide in the north-western corner ranging between 100 and 190 m deep (Figure 3-3). The seabed is generally flat or gently sloping, with an average depth change of 1 m over a distance of 10 m in waters less than 50 m deep, increasing to a depth change of 1 m over a distance of 20 m in waters over 50 m deep. Within the EMBA there are several submerged and emergent shoals and banks (Section 3.2.5).

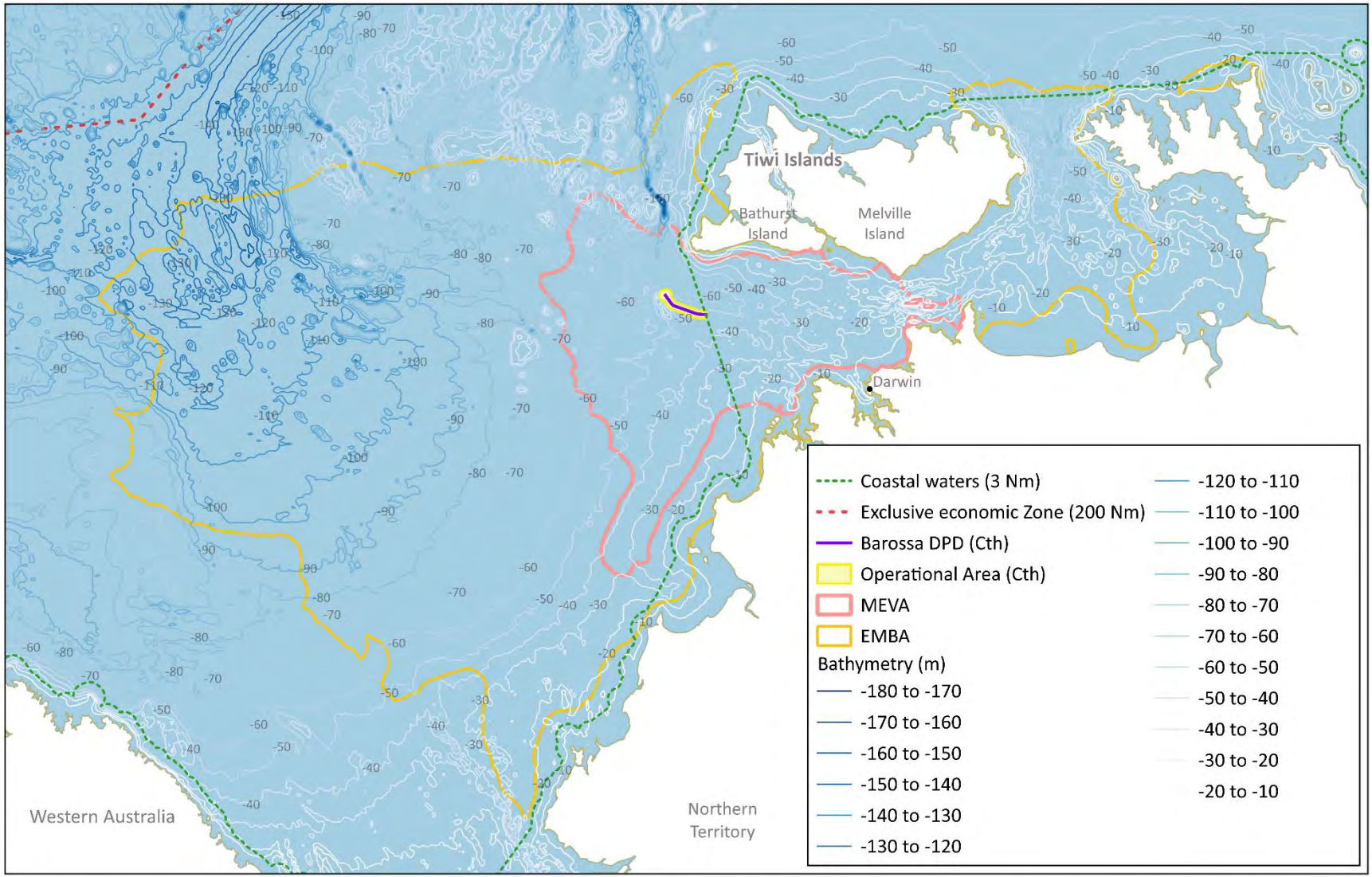


Figure 3-3: Bathymetry overlapping or proximal to the EMBA

3.2.3 Climate

The climate within the EMBA is predominantly arid tropics. Monsoonal conditions usually occur from October to March (wet season), with cooler and drier conditions prevailing from April to September (dry season).

Meteorological data for the region, recorded at the Bureau of Meteorology weather station at Melville Island (the closest metrological station to the EMBA), shows small seasonal variation in air temperature. The mean maximum summer and winter air temperatures are 34 °C and 31 °C, respectively, with annual maximum temperature of 33 °C and minimum of 22 °C. The Timor and Arafura seas region averages one tropical cyclone annually, usually occurring between November and April (BoM, 2023; 2017).

3.2.4 Oceanography

3.2.4.1 Regional current system

Large-scale currents of the Timor and Arafura seas are dominated by the Indonesian Throughflow current system (Figure 3-4). The Indonesian Throughflow brings warm, low-salinity oligotrophic waters through a complex system of currents, linking the Pacific and Indian oceans via the Indonesian Archipelago (DSD, 2010). The strength of the system fluctuates seasonally, reaching maximum strength during the south-east monsoon, and weakening during the north-west monsoon.

The Holloway Current (Figure 3-4), a relatively narrow boundary current that flows along the north-west shelf of Australia between 100 and 200 m depth, also influences the seas in the EMBA. The direction of the current changes seasonally with the monsoon, flowing towards the north-east in summer and the south-west in winter (Fugro, 2015).

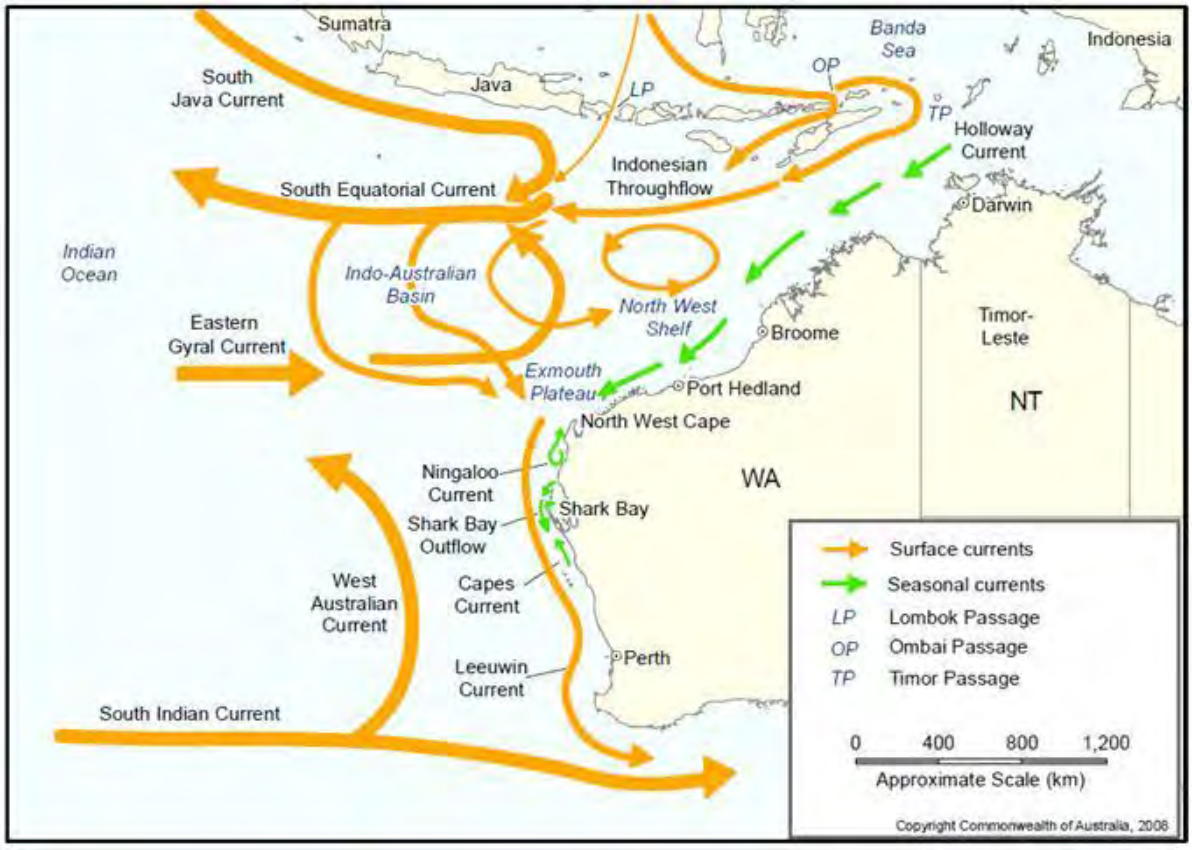


Figure 3-4: Surface currents proximal to the EMBA

3.2.4.2 Currents and tides

Water movement within the EMBA is influenced by wind and tidal activity and less by ocean currents. Smaller-scale surface currents reflect seasonal wind activity, flowing easterly to north easterly during the wet season and west to south-west during the dry season (Heyward et al., 1997).

Predicted average monthly surface current speeds are approximately 0.4 m/s within Beagle Bay Gulf just outside of Darwin Harbour (outside the Darwin Harbour Marine Management Area) and slightly less within Darwin Harbour (0.33 to 0.36 m/s in the mid-harbour) (RPS, 2023a). Predicted monthly maximum current speeds in these areas exceed 1 m/s (RPS, 2023a).

Tidal activity is typically dominated by semi-diurnal tides, with 2 daily high tides and 2 daily low tides. Tidal amplitude varies with location and distance offshore; in the Tiwi region it varies from 2 m offshore to 4 m inshore, 4–6 m in Van Diemen Gulf, while in the Beagle and Bonaparte Gulf regions the tidal range is ~6–8 m and 2–4 m respectively (IMCRATG, 1998).

3.2.4.3 Waves

Wave movements within the EMBA are expected to be composed of locally generated sea waves in response to local wind activity and swell waves created by distant wind activity. Wave height is generally between 0.6 and 0.8 m, coming from the west in the wet season and from the east in the dry season.

3.2.4.4 Temperature

Surface water temperatures in the Barossa offshore development area were recorded as generally ranging between 27 °C and 30 °C, while temperatures in the upper water column of the Barossa offshore development area were recorded as reaching a maximum of 30.9 °C in summer and a minimum of 24.7 °C in spring (Fugro 2015). Mean temperatures ranged from 28.1 °C at 34 m below MSL (summer) to 12.6 °C at 253 m below MSL (summer) (Fugro, 2015). Water temperatures within the EMBA are expected to be broadly within the ranges of those observed in the development area.

3.2.5 Shoals and banks

A number of shoals and banks occur within the EMBA (see Table 3-5). Few historic studies of these features exist, with most of the understanding of shoals and banks in the region derived from the 'big bank shoals' study (Heyward et al. 1997), PTTEP surveys initiated in response to the Montara incident (Heyward et al., 2010; Heyward et al., 2011) and studies undertaken by AIMS for the Barossa Development (Heyward et al., 2017; Radford et al., 2019).

The biological communities of the shoals and banks within the EMBA are well represented in the broader region (Heyward et al., 2017). AIMS' analysis of survey data showed that the most influential determinants of benthic community composition include depth and light intensity, substrate type and complexity, hydrodynamic environment and position on the continental shelf. 'Mid-shelf' locations, such as those within the EMBA, typically exhibit higher turbidity, resulting in greater light attenuation and the transition between primary producer dominated habitats (such as corals) to those featuring sessile filter feeders (e.g. sponges) is often observed at shallower depths. Consequently, coral reef communities are expected to only be associated with the shallower reefs, shoals and banks, particularly further away from the turbid coastal fringe where sponges, sea fans and to a lesser extent gorgonian soft corals are the dominant contributors to benthic communities (Heyward et al., 2017).

The shoals and banks within the EMBA are expected to support many common species, but to show variation in the abundance and diversity of substrate types and dominant benthic species, with subsets of species featuring more prominently on some shoals and banks than others (Heyward et al., 2017). Shepparton Shoal, immediately south-west of the OA, is dominated by filter feeder communities (Radford et al., 2019). Other shoals and banks within the EMBA (e.g. Flat Top Bank) that were surveyed by AIMS for the Barossa marine studies program show a very high degree of similarity (>90%) to other banks located regionally (e.g. Goodrich Bank, located approximately 147 km from the OA and outside of the EMBA). Table 3-6 summarises the survey results within the EMBA.

Table 3-5: Distances to the nearest shoals and banks from OA

Geomorphic feature	MEVA	EMBA	Water depth (~m)[5]	Approximate distance/direction from OA
Shepparton Shoal	✓	✓	30–50	0.01 km SW
Afghan Shoal	✓	✓	30–50	19 km S
Flat Top Bank	✓	✓	60–70	40 km WSW
Jones Bank	✓	✓	10	50 km SE
Skottowe Shoal	✓	✓	20–30	65 km E
Moresby Shoals	✓	✓	20	70 km E
Lowry Shoal	✓	✓	20	74 km E
Newby Shoal	✓	✓	30–70	78 km ESE
Parsons Bank	✓	✓	10–20	85 km ENE
Hancox Shoal	✓	✓	10–30	87 km E

[5] *Note: water depth range provided applies to the entire feature and is not limited to the EMBA.*

Geomorphic feature	MEVA	EMBA	Water depth (~m)[5]	Approximate distance/direction from OA
Foelsche Bank	✓	✓	10	92 km E
Marsh Shoal	✓	✓	10–20	92 km E
Beagle Shoals	×	✓	20–30	142 km ENE
Taiyun Shoal	×	✓	20–30	145 km ENE
Bill Shoal	×	✓	20	154 km ENE
Abbott Shoal	×	✓	20	160 km ENE
The Boxers	×	✓	40–100	160 km NW
Renard Shoals	×	✓	20	163 km ENE
Ommaney Shoals	×	✓	20	170 km ENE
Wells Shoal	×	✓	20–30	176 km ENE
Barbara Shoal	×	✓	20	185 km E
Giles Shoal	×	✓	20–30	190 km ENE
Mataram Shoal	×	✓	20–40	205 km ENE
Fitzpatrick Shoal	×	✓	30–40	210 km ENE
Howland Shoals	×	✓	10	217 km SW
Deep Shoal 2	×	✓	110–130	266 km W

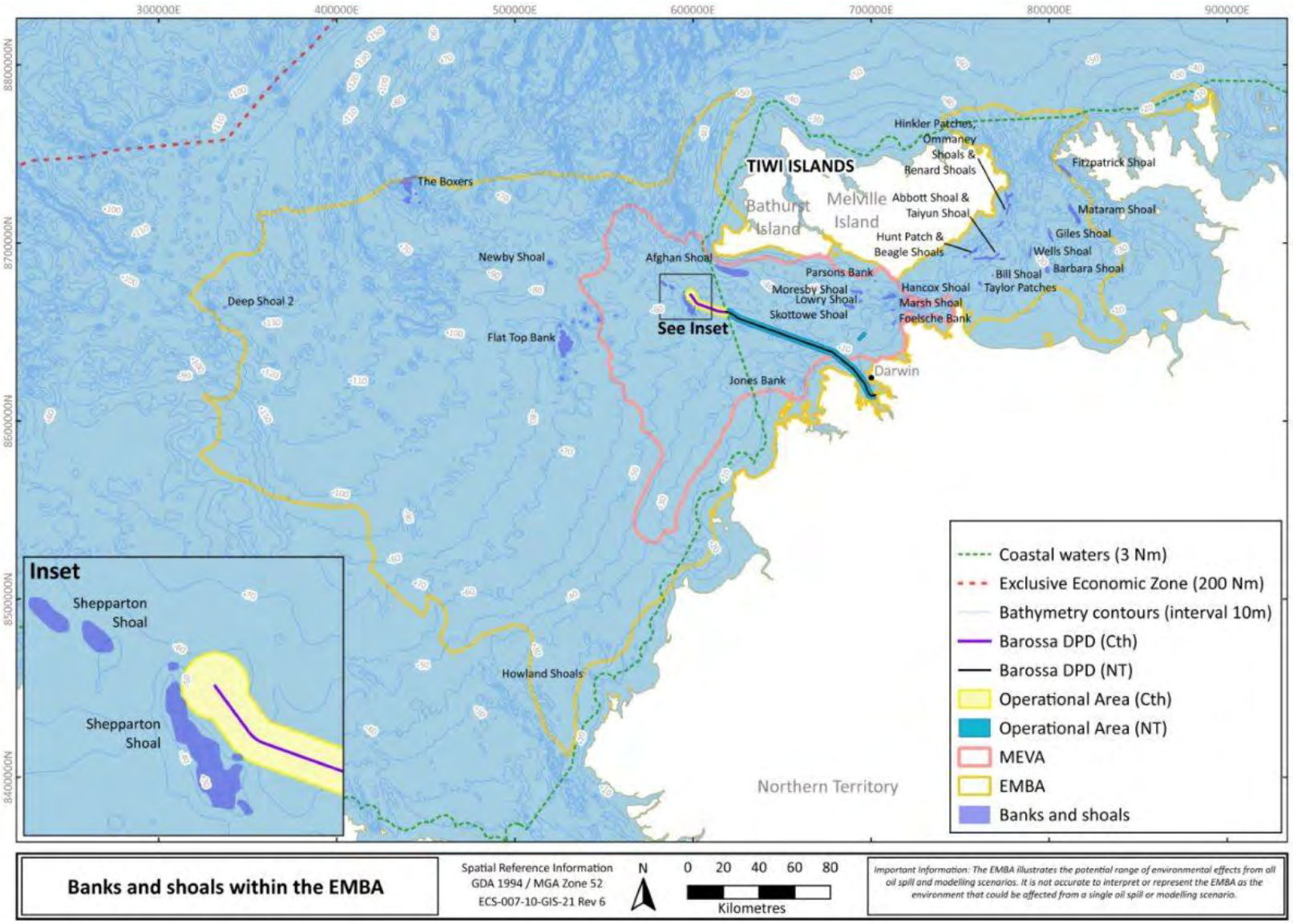
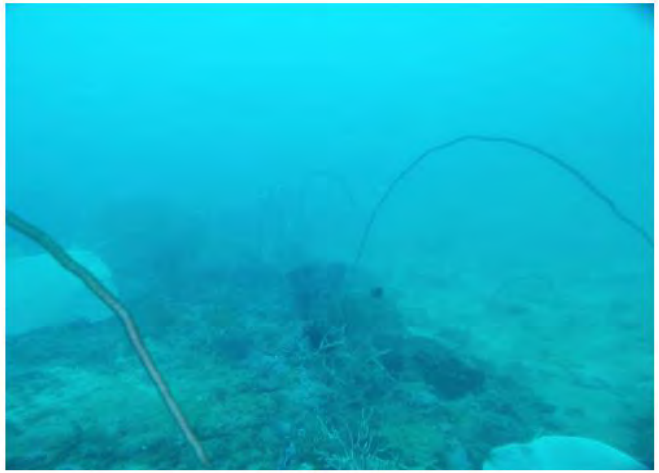


Figure 3-5: Banks, reefs and shoals overlapping or proximal to the OA and EMBA

Table 3-6: Summary of the results of the marine studies program

Feature	Description
Oceanic Shoals AMP (within and proximal)	Surveys of benthic habitats and fish communities were undertaken by AIMS within and adjacent to the Oceanic Shoals AMP, in the proximity of the Bayu Undan pipeline, in 2017 (Radford et al., 2019). The benthic survey included six sites between Goodrich Bank and Bathurst Island as well as Shepparton Shoal (see below). Fish communities were surveyed at five of the sites. Benthic habitats at the six sites were dominated by extensive areas of seabed covered in unconsolidated sediments such as coarse sand and mud (see photo for example of habitat type). Epibenthic fauna were present at low densities, attached to areas of consolidated pavement covered in fine sediment, or on low relief rock outcropping, most commonly present around ridges or drop-offs. Light-dependent communities were absent from most sites and where present were typically sparse. Corals were very rare and outside of bare areas, non-photic filter-feeder communities (notably sponges) were the key habitat. However, these filter feeder communities were frequently sparse, with decreasing density with depth, and very little occurrence beyond 50 m water depth (Radford et al., 2019).  Fish species richness recorded at the sites surveyed was low compared to other shoals on the north-west shelf of Australia, reflecting the greater proportions of bare biotic cover and sandy substrate. Fish communities were dominated by bony fish, with sharks and to a lesser extent rays also common. Relative abundances were less than half those recorded at shoals further offshore, such as Tassie and Evans Shoals (both outside the EMBA). Richness, abundance and structure of fish communities across sites were strongly correlated with habitat characteristics, with greatest numbers linked to increased epibenthic cover (Radford et al., 2019).
Shepparton Shoal	 Shepparton Shoal is relatively shallow (~30 m) and differed from most other sites surveyed by having up to medium density filter-feeder communities (see photo for example of habitat type) predicted over most (86%) of the shoal (Radford et al., 2019). No hard or soft corals, or Halimeda communities were recorded and areas not supporting non-photic filter feeders were expected to comprise bare substrates (Radford et al., 2019). Fish were not surveyed at this site, but given the depths and habitat types present can be expected to be dominated by bony fishes, likely including stripey snapper (*Lutjanus carponotatus*), rockcod (*Epinephelus* spp), sandperch (*Parapercis* spp), threadfin bream (*Pentapodus emeryii*) surgeonfish (*Acanthurus* spp) and angelfish (*Chaetodontoplus duboulayi*).

3.2.6 Offshore reefs and islands

The EMBA does not overlap any of the key offshore reefs and islands in Commonwealth waters of the region.

Several nearshore islands fall within the EMBA, most notably the Tiwi Islands where the EMBA approaches and/or intersects parts of the south-west, south and east coastlines.

The Tiwi Islands are situated about 25 km north-east of the OA, 80 km north of Darwin and are comprised of Melville Island, Bathurst Island and nine smaller uninhabited islands off the northern and southern shores. The islands cover an area of about 8,320 km^2 and support a number of important habitats, including extensive stands of mangroves, tidal mudflats, sandy beaches, seagrass meadows and fringing reef habitats (INPEX, 2010). Many species found on the islands are not recorded anywhere else in the NT, primarily due to their isolation and climatic extremes (high rainfall) (NRETAS, 2009a). The Tiwi Islands are Aboriginal freehold land owned by the Tiwi Aboriginal Land Trust (ALT) (NRETAS, 2009a). A mapping exercise has been undertaken with the Tiwi Land Council (TLC) to identify environmental and socioeconomic values along the Tiwi Islands coastline (Jacobs, 2019).

The Tiwi Islands, and the small islands nearby, provide important nesting sites for marine turtles, internationally significant seabird rookeries, and some major aggregations of migratory shorebirds (DLRM, 2009). A number of BIAs for turtles are found along the coastlines of the Tiwi Islands (see Section 3.2.12.2.1). The sandy beaches on the Tiwi Islands, specifically the west coast of Bathurst Island and the north coast of Melville Island, are particularly important for marine turtle nesting. Nesting is dominated by flatback and olive ridley turtles (Chatto & Baker, 2008). However, green and hawksbill turtles also nest on the Tiwi Islands. Significant numbers of olive ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island (Chatto & Baker, 2008), but these areas are not within the EMBA.

Five seabird breeding colonies have been reported on small offshore islands surrounding Melville and Bathurst islands (Chatto, 2001) that range in size from 2 to more than 30,000 birds (Chatto 2001). The colony on Seagull Island, off the north-west tip of Melville Island and outside the EMBA, supports a breeding BIA of about 60,000 crested terns (Woinarski et al., 2003). This is thought to be the largest breeding colony of this species and is considered an internationally significant colony (>1% global population) (NRETAS, 2009a). A 20 km buffer has been designated around the BIA as a foraging zone for crested terns (see Section 3.2.12.4). The breeding period for the crested tern is from March to July, with most eggs being laid between from late April to early June (Chatto, 2001). In general, colonial seabird breeding in the NT occurs throughout most of the year, though mostly between May and November (Chatto, 2001). The extensive areas of tidal flats, particularly on the south-east of Melville Island, have also been noted as providing important wading and feeding habitats for shorebirds. The highest total count at this site was 40,000 shorebirds in 1993 with the most common species being great knots (Chatto, 2003). Other species recorded in high numbers include red-necked stints, greater and lesser sand plovers and bar-tailed godwits (Chatto, 2003).

3.2.7 Other seabed features of interest

3.2.7.1 Seamounts

Seamounts have been identified ~230km north of the OA and may be present sporadically within the EMBA. The Barossa environmental baseline studies program (Jacobs, 2016c) included sampling sites at seamounts to the west of the field. Seamounts are generally raised up from the seabed to water depths between 50 and 80 m and are characterised by predominantly sand and rubble (Jacobs, 2016). The hard substrate of the seamount slopes support epibenthic communities dominated by sponges and filter feeders such as gorgonians (e.g. sea whips, sea fans and soft corals) and feather stars. Other epibenthic species observed included holothurians (sea cucumbers), sea fans and algae (Jacobs, 2016c).

Triggerfish nesting areas were apparent at the seamounts. The triggerfish (family *Balistidae*) appeared to make depressions in the sand and rubble at the top of the southernmost seamount surveyed, as they were observed in and around these depressions (Jacobs, 2016c). The seamounts also appeared to support schools of fish (predominantly from the families Lutjanidae, Carangidae and Caesionidae, and including larvae or juveniles) both near the top of the seamount and at depth.

3.2.7.2 Scarps

The Barossa environmental baseline studies program (Jacobs, 2016c) included sampling sites at 2 scarps in water depths ranging between 160 and 190 m. The substrate of the scarps was similar and characterised by a hard bedrock pavement at the top, with a rocky profile along the ridge and sand habitats at the base (Jacobs, 2016c). The scarps provided habitat for gorgonians (e.g. sea whips), feather stars and other filter feeders, sponges, and hydroid/bryozoan turf. A deep-water snapper species (possibly goldband snapper) was also observed in a rocky overhang at the base of the slope and small silver fish and one ray were observed on the sand flat at one of the scarps (Jacobs, 2016c).

Scarps may be observed sporadically within the EMBA, if present likely supporting epibenthic communities, such as sponges and filter feeders and schools of fish.

3.2.8 Benthic habitats and communities

Benthic habitats predominantly refer to communities consisting of marine plants, such as seagrass and macroalgae, or invertebrates such as reef-building (hard) corals.

The mean sea level water depths within the OA range from approximately 50 m to 60 m and it is situated wholly within the continental inner shelf. The continental inner shelf typically has variable sediment types, including sub aerially exposed cemented materials and significant terrestrial sediments especially in shallower water depths. The seabed within the OA is characterised as silty, shelly sand with very sparse (<1%) epibiota (mainly soft corals and crinoids) (refer to Figure 3-6 and Figure 3-7) (RPS, 2023). Biota commonly associated with this habitat type included:

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

Santos is not aware of any information indicating that the OA contains any sensitive habitat or any benthic habitats that are not represented across other areas and/or regions. Research undertaken as part of the Barossa marine studies program confirmed offshore fishing sites were commonly associated with known shoals and were not identified along the DPD route (RPS, 2023).

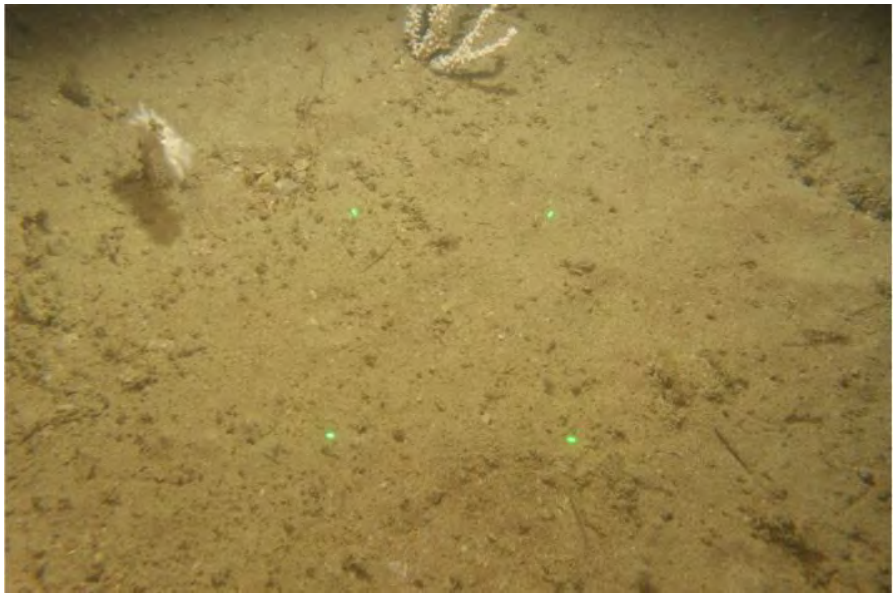
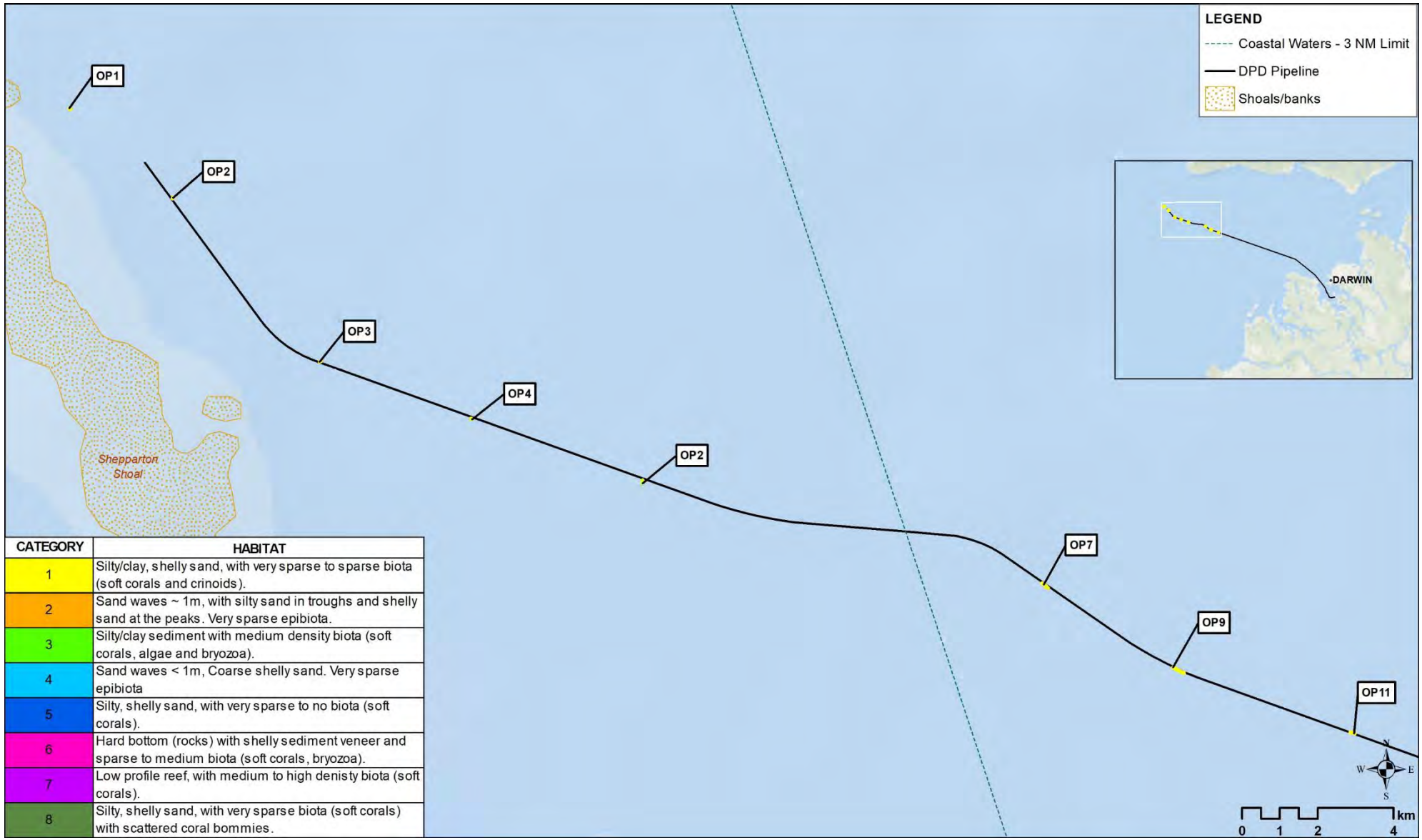


Figure 3-6: Silty, shelly sand with very sparse soft corals (*Alcyoniidae*)



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 3-7: Benthic habitat types identified along the DPD route (and portion of the DPD (NT) route) (RPS, 2023)

The distribution of benthic habitats and communities in the EMBA has been found to be primarily driven by depth and seabed characteristics, notably the presence of hard substrates and benthic rugosity (RPS, 2023b; Heyward et al., 2017; Radford et al., 2019).

A feature of the coastal and mid-shelf areas is a complex array of rises, depressions, banks, terraces and channels, giving rise to turbulence associated with tidal flows and resuspension of fine sediments causing elevated turbidity (Prezlawski et al., 2011; Radford et al., 2019). As a result, epibenthic biota are generally sparse and the dominant species present are consistent with what has been observed during other surveys of similarly turbid waters in the region (Radford et al., 2019). The benthic habitats over part of the EMBA in offshore waters have been mapped by AIMS based on data collected for the Barossa marine studies program (Heyward et al., 2017; Radford et al., 2019). Similarly, habitat mapping, most recently reviewed and revised in 2021, has been undertaken in Darwin Harbour by AIMS (Udyawer et al., 2021).

Surveys in and adjacent to the EMBA indicate that the benthos consists mostly of soft, easily re-suspended sediments interspersed with areas of hard substrate (Heyward et al., 2017; Radford et al., 2019; RPS, 2023b; Smit et al., 2000; Prezlawski et al., 2011). In general, the soft sediment habitats support very sparse to sparse epibiota, and the consolidated substrates support sparse to medium density filter-feeder communities. Overall, the diversity and coverage of epibenthos is low and organisms present are predominantly sponges, gorgonians and soft corals (Heyward et al., 2017; Radford et al., 2019; RPS, 2023b; Kelly & Prezlawski, 2012)

Areas of soft sediment support infauna communities, with infauna species richness tending to decrease with distance offshore (Prezlawski et al., 2011). Sampling of nearshore sediments in the Beagle Gulf found the infauna to be dominated by crustaceans, molluscs and echinoderms (Smit et al., 2000), with crustaceans and annelids (polychaete worms) the predominant taxa in sediments (RPS, 2023b).

Table 3-7 summarises and Sections 3.2.8.1 and 3.2.8.2 describe the benthic habitats and communities within the OA and EMBA.

Within the EMBA there are several submerged and emergent shoals and banks. Figure 3-5 illustrates and Table 3-5 lists the distances to the nearest shoals and banks (within the EMBA) from the OA. These are discussed in more detail in Section 3.2.5

The OA does not overlap any KEF. The EMBA overlaps several KEFs, which include values relating to their seabed features (CoA, 2012a; CoA, 2012b). These are discussed in more detail in Section 3.2.11.4.

3.2.8.1 Coral reefs

Hard corals within the EMBA are likely restricted to shallower areas of raised hard substrate, particularly offshore where the turbidity is reduced. Surveys of mid-shelf benthic habitats of the EMBA indicate that corals are generally rare, predominantly in <30 m water depths and more likely to develop in areas of steeper bathymetry (Heyward et al., 2017; Radford et al., 2019). Assessment of habitats in/around the Oceanic Shoals AMP suggested that the vertical depth range increases by >50 m over a 300 m horizontal distance (Radford et al., 2019).

Scattered areas of coral have been reported in Beagle Gulf and Darwin Harbour (Udyawer et al., 2021), Van Diemen Gulf/Cobourg Peninsula (NT Government, 2011) and some islands, reefs and other raised features in the inner Joseph Bonaparte Gulf may support isolated corals (Prezlawski et al., 2011). Corals in turbid waters are likely dominated by members of the genus *Turbinaria* (IMCRATG, 1998), while *Acropora* and *Montipora* species are reported to occur in clearer waters at the Vernon Islands (Smit et al., 2000; Calnan, 2006; IMCRATG, 1998). However, in general extensive hard coral reefs are unlikely to be present within the EMBA.

3.2.8.2 Seagrass

Within the coastal and shelf areas of the Northwest Shelf Transition, seagrass communities are confined to the intertidal area, with high turbidity restricting light penetration in the coastal shelf areas to waters of depths up to 20 m (DEWHA, 2008c). No seagrasses were recorded during benthic surveys at mid-shelf locations in the EMBA (Heyward et al., 2017; Radford et al., 2019) or at Shepparton Shoal, adjacent to the OA.

Seagrasses within NT waters are not well described (Butler and Jernakoff, 1999), but seagrass distribution in the region is disjointed, not common in large open bays and typically found in and around inshore islands, small bays and inlets (Roelof et al., 2005). As a result of the large tidal range and high turbidity, seagrass communities west of Nhulunbuy are considered most likely to occur in the intertidal–subtidal interface or in very shallow subtidal areas up to 5 m deep (Smit et al., 2000). Species from the genera *Halophila*, *Enhalus*, *Halodule* and *Thalassia* are likely to dominate intertidal communities (Roelof et al., 2005).

Seagrasses have been mapped in Darwin Harbour (Udyawer et al., 2021) and eastern Van Diemen Gulf, notably around Field Island (Roelof et al., 2005), with patchy seagrasses also reported from Shoal Bay, south of Shoal Bay, Bynoe Harbour and north of North Perron Island (IMCRATG, 1998; Smit et al., 2000). Areas along the east coast of Cobourg Peninsula and the northern coast of the Tiwi Islands are also reported to support seagrass communities

important to dugongs, although these areas may be mostly or entirely outside the EMBA (NT Government, 2011; PWSNT, 2003).

3.2.9 Shoreline habitats

Shoreline habitats are defined as those habitats that are adjacent to the water along the mainland and of islands that occur above the lowest astronomical tide (LAT) and most often in the intertidal zone. The EMBA intersects shorelines on the NT mainland, notably between south of Point Blaze to Cape Hotham (and including Darwin Harbour), at some coastal islands, including the south, south-east and south-western coasts of the Tiwi Islands, and other scattered locations in the NT, including the western tip of Cobourg Peninsula and the north of Croker Island (Figure 3-2). Table 3-7 summarises and Sections 3.2.9.1 to 3.2.9.4 describe the shoreline habitats within the EMBA.

3.2.9.1 Mangroves

Mangroves are common and widely distributed along coastlines of the NT (Chatto & Baker, 2008), and extensive mangals occur at many, if not most, of the tidal flats, estuaries and tidal creeks along the mainland coast and on islands that fall within the EMBA.

Coastal habitat surveying undertaken following the Montara spill (Duke et al., 2010) estimated mangroves to cover ~90% of the shorelines in Darwin Harbour and ~73% between Darwin Harbour (Mandorah) and Point Blaze. Mangroves also occur less extensively in areas of the EMBA east of Darwin, including Cobourg Peninsula. At the Tiwi Islands, the southern shorelines within the EMBA do not support the more extensive mangroves that occur within tidal creeks that open to the north coast and in Apsley Strait.

Mangroves are important primary producers and have several ecological and economic values. For example, they play a key role in reducing coastal erosion by stabilising sediment with complex root systems (Kathiresan & Bingham, 2001). They are recognised for their capacity to help protect coastal areas from the damaging effects of erosion during storms and storm surge. Mangroves are important in the filtration of runoff from land, which helps maintain water clarity for the coral reefs that are often found offshore in tropical locations (NOAA, 2010).

The muddy sediments that occur in mangrove forests are home to a variety of epibenthic, infaunal and meiofaunal invertebrates (Kathiresan & Bingham, 2001). Crustaceans known to inhabit the mud in mangrove systems include fiddler crabs, mud crabs, shrimps and barnacles. Within the water channels of the mangrove systems, various finfish are found from the smaller fish such as gobies and mudskippers (which are restricted to life in the mangroves) through to larger fish such as barramundi (*Lates calcarifer*) and the mangrove jack (*Lutjanus argentimaculatus*). Mangroves and their associated invertebrate-rich mudflats are an important habitat for migratory shorebirds from the northern hemisphere, as well as some avifauna that are restricted to mangroves as their sole habitat (Garnet & Crowley, 2000).

3.2.9.2 Intertidal mud/sand flats

Intertidal mud/sand flats form when fine sediment carried by rivers and/or the ocean is deposited in a low-energy environment. Due to the large tidal ranges, intertidal flats are common along NT coastlines and often extensive at low tide, frequently occurring adjacent to, or in conjunction with, mangrove communities in the EMBA. Duke et al (2010) indicates that intertidal mud/sand flats occur along >75% of the shore within the Darwin Harbour region and >66% of the coast between Mandorah and Point Blaze. The south-eastern coast of Melville Island also contains reasonably large areas of mud and sand flats that are exposed at low tides (Chatto & Baker, 2008). There is a large amount of intertidal mudflat, backed by extensive mangroves and open saline wetlands, in Fog Bay (southern section) and around parts of the Perron Islands (AMOSC, 2019), with this area of Fog Bay and Darwin Harbour both listed as Nationally Important Wetlands. Section 3.2.11.3 describe the wetlands of international and national importance that intersect the EMBA.

Intertidal flats are highly productive components of shelf ecosystems, responsible for recycling organic matter and nutrients through microbial activity. This microbial activity helps stabilise organic fluxes by reducing seasonal variation in primary productivity providing a more constant food supply. Intertidal sand and mudflats support a wide range of benthic infauna and epifauna which graze on microscopic algae and bivalves, molluscs, polycheate worms and crustaceans (Zell, 2007).

The high abundance of invertebrates found in intertidal sand and mudflats provides an important food source for finfish and rays which swim over the area at high tide. Mudflats have also been shown to be nursery areas for flatfish. During low tide, these intertidal areas are important foraging areas for resident and migratory shorebirds (see Section 3.2.12.4).

3.2.9.3 Sandy beaches

Sandy beaches are those areas within the intertidal zone where unconsolidated sediment has been deposited and eroded by wave and tidal action. Sandy beaches can vary from low to high energy zones, the energy experienced influences the beach profile due to varying rates of erosion and accretion.

Sandy habitats are important for both resident and migratory seabirds and shorebirds (see Section 3.2.12.4). While sand flats and beaches generally support fewer species and numbers of birds than mudflats of similar size; some species such as the beach thick knee (*Esacus giganteus*) are commonly associated with sandy beaches (Garnet & Crowley, 2000). Sandy beaches can also provide important habitat for turtle nesting (see Section 3.2.12.2.1), with female turtles traversing the intertidal beach to lay eggs in the supra-tidal zone (outside the EMBA).

Sandy beaches intersected by the EMBA include part of the extensive stretches along northern Fog Bay up to Point Paterson, at Point Blaze and on many of the islands, including the Tiwi Islands. Turtle nesting on Fog Bay and Tiwi Islands beaches within the EMBA is dominated by flatback and to a lesser extent olive ridley turtles, with the southern beaches of the Tiwi Islands supporting less activity than south-west and northern beaches (Chatto & Baker, 2008).

3.2.9.4 Rocky shorelines

Rocky shores can include pebble/cobble, boulders and rocky cliffs (often at the landward edge of reef platforms). Within the EMBA, rocky shores occur along ~12% of the coastline in the Darwin Harbour and ~30% of the mainland coast between Mandorah and Point Blaze (Duke et al., 2010), as well as a number of islands. Rocky shorelines can vary from habitats where there is bedrock protruding from soft sediments to cliff–like structures that form headlands. The Cobourg Peninsula coastlines include numerous rocky headlands and there are intermittent scattered low lateritic cliffs in the Anson-Beagle bioregion (IMCRATG, 1998).

Rocky shorelines are an important foraging area for seabirds and habitat for invertebrates found in the intertidal splash zone.

3.2.10 Plankton

Plankton abundance and distribution is patchy, dynamic and strongly linked to localised and seasonal productivity (Evans et al., 2016). Fluctuations in abundance and distribution occur both vertically and horizontally in response to tidal cycles, seasonal variation (light, water temperature and chemistry, currents and nutrients) and cyclonic events.

In northern Australia, nutrients and detritus (debris) carried by large river outflows combine with sediments and particulate organic matter resuspended by the tides and generally remain trapped within coastal areas to depths of up to ~20 m (or up to 45 nautical miles [Nm] offshore). The coastal waters within this zone generally do not mix with adjacent offshore waters, and as a result support distinctly different and more productive phytoplanktonic communities (made up of small, often microscopic, free-floating plants) than offshore waters, where nutrients are derived primarily from the ocean and atmosphere (DEWHA, 2008d).

Within the EMBA, plankton communities are likely to reflect this regional pattern, varying with depth and distance offshore. Communities of phytoplankton in coastal waters bloom and decay in response to seasonal changes in water flows, resuspension of sediments by cyclones, strong tidal currents, monsoon winds and wind-generated waves (DEWHA, 2008d). In deeper offshore areas, productivity is likely to be more dependent on internal nutrient cycling and upwellings of productive oceanic waters, such as around the shoals and pinnacles associated with KEFs of the region (see Section 3.2.11.4).

Table 3-7: Habitats within the OA and EMBA (IMCRA provincial bioregions)

Category	Receptor	OA presence	MEVA presence	EMBA presence	
				Northern Shelf Province	Northwest Shelf Transition
Benthic habitats	Coral reefs	✗	✓	✓	✓
	Seagrass	✗	✓	✓	✓
	Macroalgae	✗	✓	✓	✓
	Non-coral benthic invertebrates	✓	✓	✓	✓
Shoreline habitats	Mangroves	✗	✓	✓	✓
	Intertidal platforms	✗	✓	✓	✓
	Sandy beaches	✗	✓	✓	✓

Category	Receptor	OA presence	MEVA presence	EMBA presence	
				Northern Shelf Province	Northwest Shelf Transition
	Rocky shorelines	✗	✓	✓	✓

3.2.11 Protected and significant areas

Protected and significant areas identified in the OA, MEVA and EMBA are listed in Table 3-8 and are illustrated in Figure 3-8 to Figure 3-10. After examination, any protected or significant area listed within EPBC Act Protected Matters Reports (Appendix D) that was either outside the extent of the EMBA or a terrestrial feature has not been described within this EP.

Table 3-8: Presence of protected areas and KEFs within the OA, MEVA and EMBA, including the distance to the OA

Value/sensitivity name	Within OA	Within MEVA	Within EMBA	Distance to OA (~km)
National heritage place and world heritage property				
Kakadu National Park	✗	✗	✓	220
Australian marine parks				
Oceanic Shoals Marine Park	✗	✓	✓	44
Joseph Bonaparte Gulf	✗	✗	✓	185
Marine national parks				
Garig Gunak Barlu	✗	✗	✓	230
Wetlands of international importance (Ramsar site)				
Cobourg Peninsula	✗	✗	✓	230
Kakadu Ramsar site	✗	✗	✓	220
Nationally important wetlands				
Adelaide River Floodplain System	✗	✗	✓	118
Cobourg Peninsula System	✗	✗	✓	230
Finniss Floodplain and Fog Bay Systems	✗	✗	✓	80
Kakadu National Park	✗	✗	✓	220
Mary Floodplain System	✗	✗	✓	150
Port of Darwin	✗	✗	✓	91
Key ecological features				
North Marine Region				
Carbonate bank and terrace system of the Van Diemen Rise	✗	✓	✓	5
Pinnacles of the Bonaparte Basin	✗	✗	✓	155
North-West Marine Region				
Carbonate bank and terrace system of the Sahul Shelf	✗	✗	✓	202
Pinnacles of the Bonaparte Basin	✗	✗	✓	170

3.2.11.1 National heritage place and world heritage property

The OA does not intersect any national heritage place or world heritage property; however, the EMBA intersects the outer boundary of Kakadu National Park (see Figure 3-8, with the distances from the OA provided in Table 3-8). The majority of the Kakadu National Park encompasses the NT mainland, however, includes the mangrove-fringed

coast from Wildman River to East Alligator River and offshore islands of Barron Island (Djidbordu) and Field Island (Gardangarl) in the Van Diemen Gulf. Kakadu National Park is both a listed national heritage place and world heritage property. Kakadu is managed in accordance with the Kakadu National Park Management Plan 2016–2026 (KNPMP) (DNP, 2016). The EPBC Regulations (Schedule 8) prescribe the Australian International Union for Conservation of Nature [IUCN] management principles for each IUCN category. The Australian management principles for IUCN protected area category II require taking account of the needs and aspirations of traditional owners and other Indigenous people in the park, specifically:

- the needs of Indigenous people, including subsistence resource use, to the extent that they do not conflict with the Australian IUCN management principles
- The aspirations of traditional owners of land within the reserve or zone, their continuing land management practices, the protection and maintenance of cultural heritage and the benefit the traditional owners derive from enterprises, established in the reserve or zone, consistent with Australian IUCN management principles should be recognised and taken into account (DNP, 2016).

The Park is inscribed on the world heritage list for both cultural and natural universal values (DCCEEW, 2023c) as follows:

- criterion (I) - masterpiece of human creative genius
- criterion (VI) - directly associated with events or living traditions
- criterion (VII) - contains superlative natural phenomena
- criterion (IX) - outstanding examples of on-going evolution
- criterion (X) - important habitats for conservation of biological diversity.

The listed values within the KNPMP and protected matters reports for Kakadu National Park that overlap the EMBA are summarised in Table 3-9.

Table 3-9: Kakadu National Park values overlapping the EMBA

Management Zone(s)	Values overlapping the EMBA
National Park (IUCN II)	• biologically important areas (BIAs) for dolphins and turtles • habitat critical to the survival of flatback and olive ridley turtles • tidally influenced mudflats and mangroves provides important habitat and refuge for birds • important habitat for sawfish, river sharks, crocodiles and dugongs • Bininj are the traditional custodians of the land in the northern section of Kakadu National Park which represents a long-standing cultural interaction with landscape and culturally significant as a source of food

3.2.11.2 Marine parks

The OA does not intersect any Australian Marine Parks (AMPs) or marine national parks; however, the EMBA overlaps 2 AMPs—Oceanic Shoals Marine Park and Joseph Bonaparte Gulf Marine Park and one national marine park—Garig Gunak Barlu (Figure 3-9, with the distances from the OA provided in Table 3-8). The AMPs are divided into management zones (Figure 3-9) and managed in accordance with the North MPNMP (DNP, 2018a); the values for these AMPs that overlap the EMBA are summarised in Table 3-10. Section 3.2.14 provides information on cultural features and sea country within the AMPs and the surrounds.

In agreement with the states and NT governments, the Australian Government has committed to establish AMPs as a component of the National Representative System of Marine Protected Areas (Director of National Parks, 2012). In November 2012, the Commonwealth Marine Reserves Network was proclaimed with the purpose of protecting the biological diversity and sustainable use of the marine environment. Commonwealth marine reserves were renamed as Australian Marine Parks in October 2017 and there are six marine regions in the Australian Marine Parks Network, namely the Coral Sea, South-west, Temperate East, South-east, North and North-west.

Management plans for AMPs were developed and enacted on 1 July 2018. Under these plans, AMPs are allocated conservation objectives (International Union for Conservation of Nature [IUCN] Protected Area Category) based on the Australian IUCN Reserve Management Principles in Schedule 8 of the EPBC Regulations 2000. These principles determine what activities are acceptable within the different zones of the AMP network.

Garig Gunak Barlu is managed by the NT Parks and Wildlife Commission and declared under the *Cobourg Peninsula Aboriginal Land, Sanctuary and Marine Park Act 1981* (NT). The Cobourg Marine Park Plan of Management (NT Government, 2011) expired in 2021.

Table 3-10: Marine park values overlapping the EMBA

Value Sensitivity	Management Zone(s)	Values overlapping the EMBA
AMP		
Joseph Bonaparte Gulf	• Multiple Use Zone (IUCN VI) • Special Purpose Zone (IUCN VI)	The Joseph Bonaparte Gulf Marine Park values (DNP, 2018a): • ecosystems representative of the Northwest Shelf Transition—dynamic environment influenced by strong tidal currents, monsoonal winds, cyclones and wind-generated waves • a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act • sea country, which is valued for Indigenous cultural identity, health and wellbeing • commercial fishing, tourism, mining and recreation, including fishing, are important activities in the Marine Park.
Oceanic Shoals	• Special Purpose Zone (Trawl) (IUCN VI) • Multiple Use Zone (IUCN VI) • National Park Zone (IUCN II) • Habitat Protection Zone (IUCN IV)	The Oceanic Shoals Marine Park values (DNP, 2018a): • ecosystems representative of the Northwest Shelf Transition (which includes the Bonaparte, Oceanic Shoals and Tiwi meso-scale bioregions) • 2 KEFs: – carbonate bank and terrace systems of the Sahul Shelf – pinnacles of the Bonaparte Basin • a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act • BIAs that include foraging and internesting habitat for marine turtles • sea country, which is valued for Indigenous cultural identity, health and wellbeing • commercial fishing, tourism, and recreation, including fishing, are important activities.
Marine National Park		
Garig Gunak Barlu	• Multiple Use A Zone • Multiple Use B Zone	• Multiple Use A and B zones provide for multiple use of the park's resources, including commercial fishing activities. Multiple Use A zone has more intensive fishing, such as prawn trawling and netting. These zones also provide protection of important conservation and scientific values • provides BIAs for dolphins, seabirds and marine turtles • habitat critical to the survival of flatback, green and olive ridley turtles • habitats, feeding areas, dispersal and migratory pathways, and spawning sites for numerous fish and crustacean species of fisheries significance *Note: The EMBA intersects the perimeter of the marine park with no predicted shoreline or surface oil contact at or above low threshold values.*

3.2.11.3 Wetlands of international and national importance

The Ramsar Convention on Wetlands is an intergovernmental treaty that aims to conserve wetlands of international importance. Ramsar wetlands are recognised as MNES under the EPBC Act (DSEWPaC, 2010). No Ramsar or nationally important wetlands occur within the OA. The EMBA intersects with one Ramsar wetland—Kakadu National Park and the EMBA is adjacent to a second Ramsar wetland—Cobourg Peninsula (Figure 3-10; Table 3-11). The Cobourg Peninsula Ramsar site does not include the surrounding marine waters, and modelling predicts no shoreline contact should occur at this site. The values of the Kakadu National Park Ramsar site that overlap the EMBA are summarised in Table 3-11.

Table 3-8 describes the values of the nationally important wetlands within the EMBA, together with their distance from the OA; the values for these nationally important wetlands are summarised in Table 3-10.

Table 3-11: Wetland values overlapping the EMBA

Value Sensitivity	Description	Values that overlap the EMBA
Wetlands of international importance		
Cobourg Peninsula Ramsar site	Declared a Ramsar site in 1974. The Cobourg Peninsula system comprise of coastal and inland wetlands. It consists of intertidal forested wetlands and mudflats, seasonal freshwater marshes and permanent freshwater pools. Garig Gunak Barlu National Park includes the marine waters surrounding the peninsula, but these are not included in the Ramsar site (BMT WBM, 2011).	• N/A. This Ramsar site does not include marine waters as a value and modelling predicts no shoreline or surface oil contact at or above low threshold values.
Kakadu Ramsar site	In 2010, 2 Ramsar sites were combined to form a single Ramsar site encompassing the entire National Park, covering 19,810 km^2. The park meets all 9 criteria for identifying wetlands of international importance under the Ramsar Convention.	• BIAs for dolphins and turtles • habitat critical to the survival of flatback and olive ridley turtles • tidally influenced mudflats and mangroves provide important habitat and refuge for birds supporting more than 1% of the East Asian-Australasian Flyway population • important habitat for sawfish, river sharks, crocodiles and dugongs.
Nationally important wetlands		
Adelaide River Floodplain System	Adelaide River Floodplain System is an irregular floodplain and tidal wetland system consisting of several swamps, lakes, lagoons, mudflats, rivers and dams, covering 1350 km^2 (Jaensch, 1993).	• nationally significant mangrove habitats • significant migration stop-over area for shorebirds.
Cobourg Peninsula System	The Cobourg Peninsula system is comprised of intertidal forested wetlands and mudflats, seasonal freshwater marshes and permanent freshwater pools. The site covers 2,207 km^2 (BMT WBM, 2011).	• BIAs for dolphins, seabirds and marine turtles such as habitats, feeding areas, dispersal and migratory pathways, and spawning sites for numerous fish and crustacean species of fisheries significance.
Finniss Floodplain and Fog Bay Systems	Finniss Floodplain and Fog Bay Systems consist of a beach-fringed bay with intertidal mudflats and a floodplain with paperbark swamps. The wetland supports the breeding and migration of various bird species and significant populations of marine turtles and mammals, such as the dugong and Indo-Pacific humpback dolphin. The site covers 813 km^2 (Jaensch, 1993).	• N/A: the EMBA does not overlap the wetland (adjacent); however, the EMBA overlaps nesting and foraging BIAs for marine turtles.
Mary Floodplain System	Mary Floodplain System consists of the entire floodplain of the Mary River, covering 1276 km^2. There are 3 principal plant formations and the largest wooded swamp areas in the NT. The wetland supports a major breeding area for the magpie goose, a refuge for waterbirds and saltwater crocodiles during the dry season, and supports at least several thousand migrant shorebirds at a time.	• N/A: the EMBA does not overlap the wetland (adjacent).
Port of Darwin	Entirely tidal, with mangrove forests present, covering 488 km^2. One of the NT's largest areas of mangrove swamps and features a shallow branching embayment (Jaensch, 1993).	• major nursery area for estuarine and offshore fish and crustaceans • mangrove communities are the most extensive and species–rich of any NT embayment • provides BIAs for dolphins (Australian snubfin, Indo-Pacific humpback and spotted bottlenose) and turtles (flatback).

3.2.11.4 Key ecological features

KEFs are those components of the marine ecosystem that are important for biodiversity or the ecosystem function and integrity of a Commonwealth marine area.

The OA does not overlap any KEF. The closest KEF is approximately 6 km from the OA—Carbonate bank and terrace system of the Van Diemen Rise (Figure 3-9). Table 3-8 lists the KEFs within the EMBA, together with their distance from the OA.

3.2.11.4.1 Carbonate bank and terrace system of the Sahul Shelf

The EMBA overlaps approximately 3.5% of the Carbonate Bank and Terrace System of the Sahul Shelf KEF (Figure 3-9). The Carbonate Bank and Terrace System of the Sahul Shelf is located in the western Joseph Bonaparte Gulf, north of Cape Bougainville and Cape Londonderry. The banks consist of a hard substrate with flat tops at depths of 150 to 300 m. Each bank occupies an area generally less than 10 km^2 and is separated from the next bank by narrow sinuous channels up to 150 m deep. The area contains predictably high levels of productivity especially when compared to the generally low productivity of the region (COA, 2012a).

The banks are foraging areas for loggerhead, olive ridley and flatback turtles and provide habitat for humpback whales, as well as green and largetooth sawfish (Donovan et al., 2008 in DSEWPaC, 2012a). The hard substrate of the banks is thought to support diverse organisms including sessile benthic invertebrates such as sponges, soft and hard corals, gorgonians, bryozoans, ascidians along with associated reef fish and elasmobranchs (Brewer et al., 2007). Cetaceans, green and freshwater sawfish are also likely to occur in the area, as well as possibly the Australian snubfin dolphin, a migratory species occurring mostly on the northern extent of the Sahul Shelf (CoA, 2012a).

According to DSEWPaC (2012a), the carbonate banks and terrace system of the Sahul Shelf are regionally important because of their role in enhancing productivity. Although little is known about the banks, terraces and associated channels, they are believed to be areas of enhanced productivity and biodiversity due to the upwellings of cold nutrient-rich water at the heads of the channels and the availability of hard substrate (Brewer et al., 2007).

3.2.11.4.2 Carbonate bank and terrace system of the Van Diemen Rise

The EMBA overlaps approximately 15.7% of the Carbonate Bank and Terrace System of the Van Diemen Rise KEF (Figure 3-9). The Carbonate Bank and Terrace System of the Van Diemen Rise covers about 31,278 km^2 and forms part of the larger system associated with the Shaul Banks to the north and Londonderry Rise to the east. The value of this KEF is 'unique seafloor feature with ecological properties of regional significance' (CoA, 2012a) and it is considered important both for its role in enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity. The KEF is characterised by carbonate terrace, banks, channels and valleys, with variability in water depth and substrate composition contributing to unique ecosystems in the channels.

The carbonate banks and shoals found within the Van Diemen Rise make up 80% of the banks and shoals, 79% of the channels and valleys, and 63% of the terrace found across the NMR. The carbonate banks and shoals rise from depths of 100 to 200 m to within 10 m of the surface (Anderson et al., 2011).

A 2010 survey by Geoscience Australia and AIMS mapped the seabed environments of the Van Diemen Rise (Anderson et al., 2011). The study surveyed 784 km² towed video transects at 77 sites including banks, terraces, valleys and plains within the Van Diemen Rise. The shallow banks sampled contained complex benthic features with diverse and often dense epibenthic assemblages. A total of 175 video characterisations were recorded from 13 bank sampling sites in the study area from depths of 11 to 54 m (mean depth of 34 m). The sites were characterised by mostly low-lying rock outcrops with hard corals and octocorals (18% and 99% occurrence, respectively) along with smaller colonies of bryozoa and ascidians. The rocky outcrops were interspersed by small areas of relatively barren coarse-grained soft sediments (Anderson et al., 2011).

The KEF provides habitat for a high diversity of sponges, soft corals and other sessile filter feeders, epifauna and infauna, along with olive ridley turtles, sea snakes and sharks. Rich sponge gardens and octocorals have been identified on the eastern Joseph Bonaparte Gulf along the banks, ridges and some terraces. Plains in deep hole/valleys are characterised by scattered epifauna and infauna that include polychaetes and ascidians. Epibenthic communities such as the sponges found in the channels are likely to support fish and second-order consumers. Pelagic fish such as mackerel, red snapper and a distinct gene pool of gold band snapper are found in the Van Diemen Rise.

3.2.11.4.3 Pinnacles of the Bonaparte Basin

The EMBA overlaps approximately 36.4% of the Pinnacles of the Bonaparte Basin KEF (Figure 3-9). The limestone pinnacles of the Bonaparte Basin are located in the mid-outer shelf of the western Joseph Bonaparte Gulf and comprise of 61% of the limestone pinnacles in the Northwest Marine Region and 8% of the total limestone pinnacles found within the Australian Exclusive Economic Zone (EEZ) (Baker et al., 2008). The pinnacles are found in waters 30 to 80 m deep and provide hard substrate for sessile species. The pinnacles are thought to be remnants of the calcareous shelf and coastal features from previous low sea-level stands and have been recorded to be up to 50 m in height and range from 50 to 100 km long (Baker et al., 2008; Heyward et al., 1997).

Diverse communities of sessile benthic invertebrates including hard and soft corals, sponges, whips, fans, bryozoans and aggregations of demersal fish species such as snappers, emperors and groupers have been

recorded (Brewer et al., 2007). Foraging and general use has been recorded within the pinnacles by marine turtles and the area has also been suggested to be used by freshwater and green sawfish as well as humpback whales (Donovan et al., 2008). The pinnacles have been recognised as a sponge biodiversity hotspot supporting greater diversity and communities than the surrounding seafloor (NERP MBH, 2014).

The Pinnacles of the Bonaparte Basin are defined as a KEF as they are a unique seafloor feature with ecological properties of regional significance. Their biodiversity value relates to both the benthic and pelagic habitats (CoA, 2012a). The hard substrate of the pinnacles is likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required.

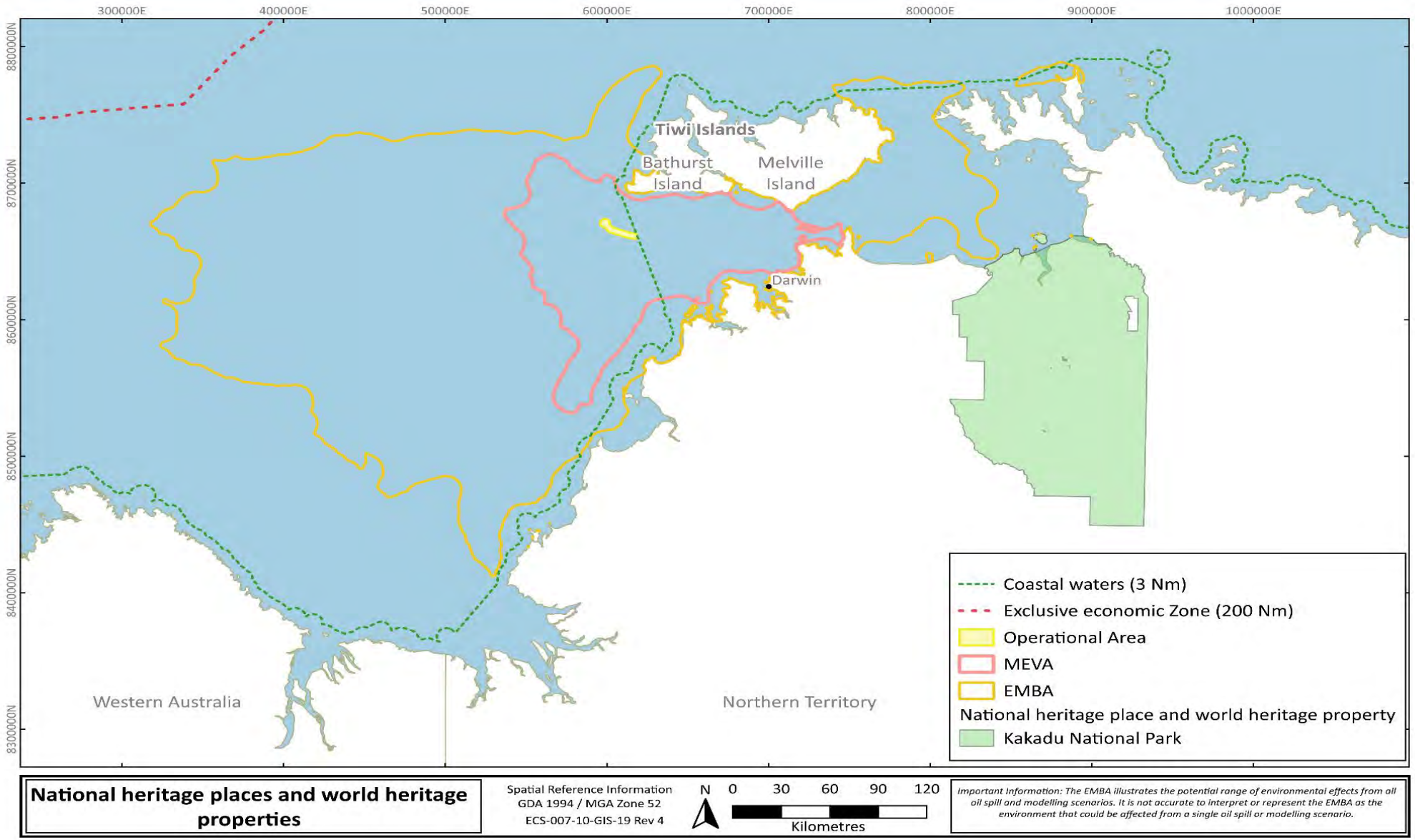


Figure 3-8: National heritage place and world heritage property proximal to the EMBA

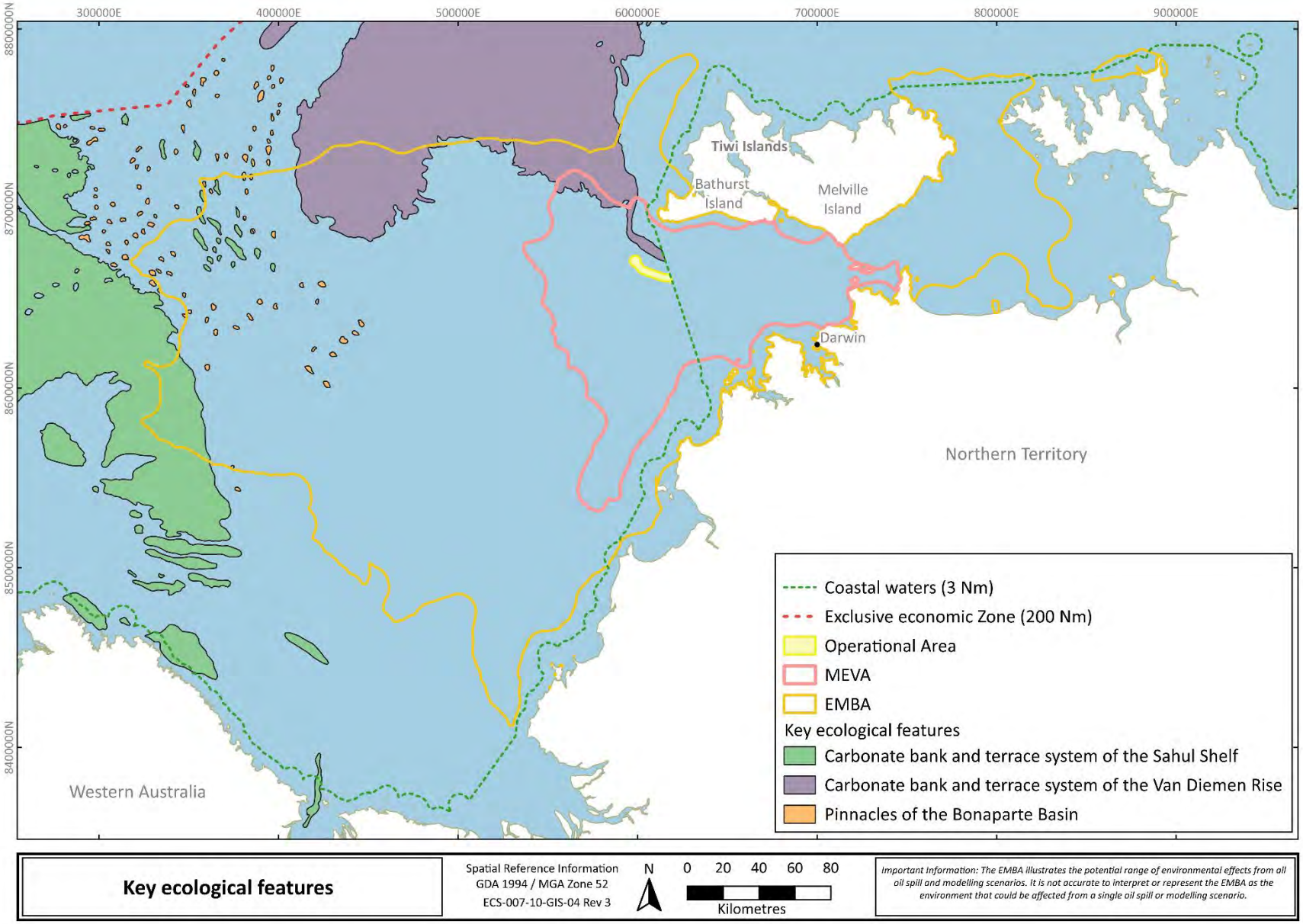


Figure 3-9: Key ecological features within or proximal to the EMBA

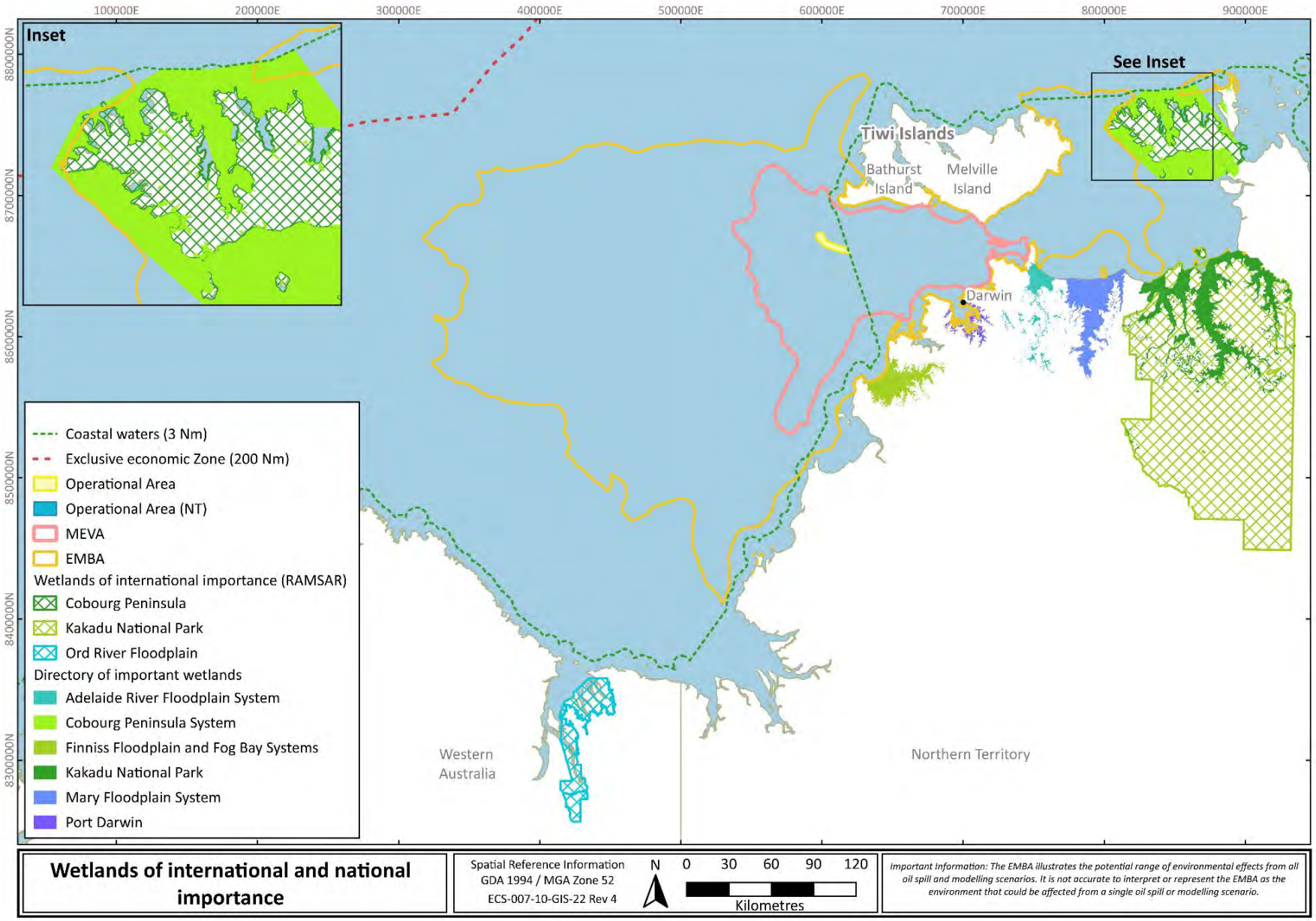


Figure 3-10: Wetlands of international and national importance within or proximal to the EMBA

3.2.12 Threatened and migratory fauna

Table 3-12 lists the environmental values and sensitivities (threatened and migratory species) within the OA and EMBA as identified from the EPBC Act protected matters reports (Appendix D). Threatened and migratory species are Matters of National Environmental Significance (MNES) protected under the EPBC Act. The EPBC Act protected matters reports (Appendix D) also provide a list of identified marine and cetacean species, including excluded terrestrial species (other matters protected under the EPBC Act). Table 3-12 also lists the threatened species protected under the *Territory Parks and Wildlife Conservation Act 1976* (NT) (TPWC Act) that have the potential to occur within the EMBA.

For each species identified, the extent of the likely presence is listed in Table 3-12 and described in Sections 3.2.12.1 to 3.2.12.4.

The scalloped hammerhead is EPBC Act listed as conservation dependent under the threatened listing assessment. As a result, this species has been included for assessment as the listing status could be revised to a threatened species listing status during the Activity. One additional species—the grey nurse shark (*Carcharias taurus*; EPBC Act listed 'vulnerable')—is included in the following sections as they were reported as occurring within or near the OA as part of the Barossa marine studies program.

Relevant conservation advice, recovery plans and management plans for marine fauna identified in the EPBC Act Protected Matters Reports are listed in Table 3-14.

Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the EPBC Act protected matters report for the EMBA and do not have habitats along shorelines, are not relevant to the activity impacts and risks have been excluded from Table 3-12.

3.2.12.1 Marine Mammals

3.2.12.1.1 Whales

Blue whale

The blue whale (*Balaenoptera musculus*; Endangered under the EPBC Act, Migratory) has 4 distinct sub-species, 2 are found in the southern hemisphere—the pygmy blue whale (*Balaenoptera musculus brevicauda*; Indo-Australian and Tasman-Pacific populations) and Antarctic blue whale (*Balaenoptera musculus intermedia*; CoA, 2015a). As southern blue whales occur in waters south of 60°S and pygmy blue whales north of 55°S (CoA, 2015a), only pygmy blue whales are discussed below.

The pygmy blue whale is known to migrate along the WA shelf edge at depths between the 500 m and 1,000 m depth contours from the NW Cape south to Geographe Bay (CoA, 2015a). A biologically important migration corridor is recognised in the deep offshore waters off WA (IUCN-MMPATF, 2023a). The northerly migration toward the calving grounds near the equator occurs in March/April to June (Thums et al., 2021; CoA, 2015a). Noise modelling as part of assessment studies detected the presence of blue whales over 400 km north-east of the migration BIA for the species in the months of May to August during their north-bound seasonal migration. No detections of the species were made during the period of their southward migration (McPherson et al., 2016). The southerly migration to the feeding grounds in the high latitudes of the southern hemisphere occurs in September to December (CoA, 2015a). Pygmy blue whales appear to travel as individuals or in small groups when making their migrations (Woodside, 2014).

Generally, this species travels alone or in small groups based on acoustic data. Pygmy blue whale calls from noise loggers deployed around Scott Reef from 2006 to 2009 for the Woodside Browse project found 78% of calls to be from single whales, 18% from whale pairs and 4% from 3 or more whales (Woodside, 2014).

There are no BIAs for pygmy blue whales identified within the EMBA and, if present, are likely to be transient and in low numbers.

Bryde's whale

Bryde's whales (*Balaenoptera edeni*; Migratory) are distributed across tropical and warm temperate waters with individuals recorded in all Australian states, except the NT (Ceccarelli et al., 2011). The species typically moves between 40 °N and 40 °S, with these movements seeming to be primarily linked to prey availability (Kato, 2002). Bryde's whales are thought to be divided into offshore and onshore forms with the distinction between the 2 based on prey preference (Ceccarelli et al., 2011). The offshore form is found in deeper waters (500 to 1,000 m) and is thought to migrate seasonally in favour of warmer waters in winter months. The onshore form generally inhabits waters over 200 m and displays no distinct migratory movements (Jenner et at., 2001). Noise monitoring as part of assessment studies detected Bryde's whales almost year-round from January to October (McPherson et al., 2016) and this species has been encountered off Browse Island (Ceccarelli et al., 2011). Bryde's whales may occasionally transit through the EMBA in small numbers.

Fin whale

Fin whales (*Balaenoptera physalus*; Vulnerable under the EPBC Act, Migratory) are widely distributed from polar to tropical waters and have been recorded in all Australian states, other than NSW and the NT (Bannister et al., 1996). Fin whales feed on planktonic crustacea, such as Antarctic krill, and primarily forage in high latitudes.

The species rarely occupies inshore waters and displays well defined migratory movements (essentially north south) between polar, temperate and tropical waters (Ceccarelli et al 2011; Bannister et al. 1996). Research by Aulich et al. (2022; 2019) found that fin whales travel up the WA coast as far north as Dampier (19°S). After arriving at Cape Leeuwin in April, the species migrates north along the coast to feed in Perth Canyon from May to October. This is thought to be a migratory pathway from Antarctica, and it has been suggested that there are separate fin whale sub-populations on the east and west coasts of Australia (Aulich et al., 2022; 2019). Within Australian waters, the Bonney Upwelling is thought to be an important foraging ground for this species (TSSC, 2015c; Bannister et al., 1996).

The Australian fin whale distribution is unclear due to limited observations, but the species is thought to be present from Exmouth along the southern coastline to Queensland. There are no known mating or calving areas in Australian waters and no BIAs have been developed for fin whales (TSSC, 2015c). Given their distribution and movements, fin whales are considered unlikely to occur in the EMBA.

Humpback whale

The humpback whale (*Megaptera novaeangliae*; Migratory) has a wide distribution with recordings throughout Australian Antarctic waters and offshore from all Australian states (IUCN-MMPATF, 2023b; Bannister et al., 1996). These whales migrate between summer feeding grounds in Antarctica and winter breeding and calving grounds in the sub-tropical and tropical inshore waters of north-west Australia (Jenner et al., 2001). Although the exact timing of migration varies annually due to a number of factors including water temperature, the northbound migration peaks between late July and early August, and the southbound migration peaks between late August and early September (Jenner et al., 2001).

There has been a steady recovery in the humpback whale population that migrates along the WA coast since the closure of commercial whaling, and as a result the species was removed from the EPBC Act threatened species list in 2022 (TSSC, 2022).

Humpback whales breed and calve in the NWMR between Broome and the northern end of Camden Sound in the months of June to September each year (DCCEEW, 2024j) and a breeding and calving BIA for humpback whales is recognised in nearshore waters adjacent to the northern half of the Dampier Peninsula and encompasses Camden Sound (DCCEEW, 2024j).

Relatively few humpback whales have been known to travel north of Camden Sound (Jenner et al., 2001) and Barossa Development baseline studies did not detect any humpback whale calls in the Timor Sea (McPherson et al., 2016).

There are no BIAs for this species within the EMBA and given the available information on its distribution, it is considered unlikely to occur within the EMBA.

Sei whale

Sei whales (*Balaenoptera borealis*; Vulnerable under the EPBC Act, Migratory) are thought to have a wide distribution, but their distribution limits are unclear as this species is often confused with Bryde's whales. Sightings are rare, but the species may be seen in coastal and offshore waters throughout Australia (DCCEEW, 2024j; Bannister et al., 1996). The species is able to utilise a diverse range of marine habitats, which has been attributed to a combination of dynamic physical and prey processes (DCCEEW, 2024j).

Sei whale migratory movements are well defined with distinct north-south movements as the species migrates between polar, temperate and tropical waters for foraging and breeding. The species feeds intensively between the Antarctic and sub-tropical convergences on planktonic crustacea (Ceccarelli et al., 2011; Bannister et al., 1996). There are no known mating or calving areas in Australian waters and the species is thought to infrequently occur in the NW region (Ceccarelli et al., 2011).

There are no BIAs for this species in Australian waters. However, it is possible that individual sei whales may occasionally occur within the EMBA.

3.2.12.1.2 Dolphins

Australian humpback dolphin

The Australian humpback dolphin (*Sousa sahulensis*; Migratory, previously/also known as the Indo-pacific humpback dolphin, *Sousa chinensis*) occurs in waters of the Sahul Shelf, from northern Australia to the Kikori Delta in Papua New Guinea, and Bird's Head Seascape in West Papua (Jefferson & Rosenbaum, 2014). Although distribution, life history and habitat preferences of this species are poorly understood, the Australian humpback

dolphin is thought to be associated with shallow coastal, estuarine and tidal river waters less than 20 m in depth (Hanf et al., 2022).

In Australia, humpback dolphins occur along the northern Australian coastline from Shark Bay in WA to southern Queensland (Raudino et al., 2018; Hanf et al., 2022). In the NWMR, this species is thought to inhabit coastal waters up to the 30 m isobath (Hanf et al., 2022), but Australian humpback dolphins have been recorded up to 60 km offshore near Barrow Island, the Montebello Islands (approximately 80 km from the mainland coast and 20 km from Barrow Island), and the western Lowendal Islands (Raudino et al., 2018). Available abundance estimates indicate that this species occurs in small populations with an average of up to 89 individuals and a maximum of 0.19 individuals per km² (Parra & Cagnazzi, 2016).

There are breeding BIAs for Australian humpback dolphins in Darwin Harbour and at Kakadu National Park that overlap the EMBA (Figure 3-11).

Australian snubfin dolphin

The Australian snubfin dolphin (*Orcaella heinsohni*; Migratory), previously known and only recently differentiated from the closely related Irrawaddy dolphin (*Orcaella brevirostris*), is a poorly known species inhabiting shallow coastal and estuarine waters and tidal rivers. The species typically occurs in water depths of less than 20 m in the vicinity of freshwater outflows, but has been recorded up to 23 km offshore (Bouchet et al., 2021). The Australian snubfin dolphin is likely to occur in higher densities in areas of complex habitat type which provide a variety of prey types (Palmer et al., 2014).

In Australia, this species occurs in coastal waters of Queensland, NT and north-western Australia. The population in Australian waters is thought to be continuous with the Papua New Guinea species but separate from populations in Asia. Breeding is thought to occur throughout the year for this species and there are breeding BIAs that overlap the EMBA in Darwin Harbour and at Cobourg Peninsula.

Killer whale

The largest member of the dolphin family, killer whales or orca (*Orcinus orca*; Migratory) are a cosmopolitan species with a vast global distribution across a wide range of habitats. However, they appear to be primarily concentrated in coastal waters and cooler regions of high productivity as they are carnivores with a diet that varies seasonally and regionally (DCCEEW, 2023j; Bannister et al., 1996).

Globally, killer whales are known to migrate; however, specific routes and seasonal movement patterns are not known in detail and are thought to relate to prey availability (Bannister et al., 1996).

Killer whales are distributed throughout Australian waters, typically observed moving along the continental slope and shelf, and near seal colonies (Bannister et al., 1996). Migration movements within Australian waters include a summer migration from subantarctic islands to Macquarie Island (DCCEEW, 2023j). While killer whales are known to undertake seasonal migrations and follow regular migratory routes, little is known about these movements (DCCEEW, 2023j).

Killer whales are often observed around seal colonies and may be associated with humpback whale migrations, neither of which occur in the vicinity of the EMBA. No BIAs or migration routes have been identified for this species within the EMBA, although they may occur in low numbers.

Spotted bottlenose dolphin (Indo-pacific bottlenose dolphin)

The spotted bottlenose dolphin (Arafura/Timor Sea populations; *Tursiops aduncus*; Migratory) is primarily found in nearshore continental shelf waters less than 200 m deep, with rocky or coral reefs, sandy, soft sediments, or seagrass beds (DSEWPaC, 2012a). Small populations also occur in the inshore waters of some oceanic islands (Ceccarelli et al., 2011).

In Australia, migration patterns for the species are variable, including year-round residency in small areas, long-range movements and migration (DCCEEW, 2023j). The species occurs in NT open coastal waters, primarily within the continental shelf and around oceanic islands. Spotted bottlenose dolphins forage in a wide range of habitats and in deeper waters than most dolphins. Groups are resident at Browse Island, Rowley Shoals and other island and reef complexes in offshore waters (Ceccarelli et al., 2011).

There is a breeding/calving BIA located in Darwin Harbour for the Indo-Pacific bottlenose dolphin that overlaps the EMBA (Figure 3-11). Given spotted bottlenose dolphin use relatively deeper waters and potentially travel large distances, it is likely this species will also transit through other parts of the EMBA.

3.2.12.1.3 Dugong

Dugongs (*Dugong dugon*; Migratory) occur in tropical and sub-tropical coastal and island waters. They are commonly found in shallow areas to 25 m depth but have been observed in waters up to 37 m deep (Marsh, n.d.). Dugong feeding aggregations tend to occur in large seagrass meadows within wide shallow protected bays, shallow mangrove channels and in the lee of large inshore islands. Although the movements of most individuals

are limited to tens of kilometres in the vicinity of seagrass beds some individuals travel up to 1,000 km (Hobbs & Willshaw, 2015; Whiting, 2008).

Dugongs in the Torres Strait have large home-range sizes compared to other regions, likely due to the vast areas of seagrass, including over 13,000 km^2 of deep-water seagrass, the largest continuous area in Australia (Deutsch et al., 2022). This, along with large seagrass beds in shallow water around reefs, enables dugongs to travel long distances while staying relatively close to accessible food sources (Deutsch et al., 2022).

In northern Australia, the Darwin region supports a dugong population travelling over 300 km between rocky reef habitats (Whiting, 2008), and key sites for dugong conservation have been identified around Cobourg Peninsula, Croker Island and the north coast of the Tiwi Islands (PWSNT, 2003) which all partly overlap the EMBA. Aggregations at these sites rank in the top eight dugong populations in Australia (PWSNT, 2003). Dugongs tracked in the INPEX Ichthys Project baseline surveys were recorded around the Vernon Islands, south of Melville Island, and spent time in Darwin Harbour and around the Tiwi Islands (INPEX, 2010).

There are no BIAs for dugong within the EMBA, but the species is likely to occur in suitable habitats.

3.2.12.1.4 Water mouse

The water mouse (*Xeromys myoides;* Vulnerable under the EPBC Act) is a small rodent and occurs in and near coastal Queensland and NT. In NT, the water mouse habitat spans several areas, including floodplains along Glyde and Tomkinson Rivers in Arnhem Land, South Alligator and Daly Rivers in Kakadu National Park, and Melville Island. Based on the habitat preferences, it is considered unlikely to occur within the EMBA. The main threats identified for the water mouse include:

- land use change.
- increasing human presence.
- invasive predators like foxes and cats (DAWE, 2021).

3.2.12.2 Marine Reptiles

3.2.12.2.1 Marine Turtles

Flatback turtle

Flatback turtles (*Natator depressus*; Vulnerable under the EPBC Act; Migratory) are known to occur along the WA, NT and Queensland coastlines, and forage widely across the Australian continental shelf and into the continental waters off Indonesia and Papua New Guinea (CoA, 2017b). Flatback turtles are primarily carnivorous, predominantly feeding on soft-bodied invertebrates. This species breeds in the region, with the highest density rookeries found to be winter at Cape Domett and summer at Eighty Mile Beach, while moderate to lesser density nesting in winter occurred in the North Kimberley offshore islands (Tucker et al., 2021). Flatback turtles that nest within the Pilbara region typically migrate along the continental shelf to foraging grounds as far north as Darwin at the end of the nesting season, returning to breed at varying intervals of a year or more (Thums et al., 2020; CoA, 2017b). Tracking studies have shown individuals migrating from northern WA into Queensland waters and (conversely) from Deliverance Island in Queensland to Kimberley waters, with the waters around the Tiwi Island supporting migrating and foraging flatbacks (Pendoley, 2023).

Flatback turtles nesting within the NT are from the Arafura Sea breeding and genetic stock, with unknown long-term trends for this stock (CoA, 2017b). Nesting has been recorded on the Tiwi Islands, with flatback turtles the predominant nesting species on the southern and south-western beaches that fall within the EMBA (Pendoley, 2023). The greatest proportion of activity occurs on the west coast of Bathurst Island (Chatto & Baker, 2008) with nesting females numbering around 11 to 100 per year, which is comparable to or smaller than other nesting sites of the Arafura Sea genetic stock. Nesting and internesting occurs year-round with a peak during June and August, and hatchling emergence peaking between July and September (CoA, 2017b).

The Recovery plan for marine turtles in Australia defines a 60 km internesting buffer around the Tiwi Islands (CoA, 2017b). Whittock et al. (2016) defined suitable internesting habitat as waters up to 16 m deep within 5 to 10 km of the coastline, and unsuitable internesting habitat as waters over 25 m deep and more than 27 km from the coastline. They also tracked internesting flatback turtles from 5 different mainland and island rookeries and found that these turtles not only stayed in waters less than 44 m deep, but were associated with a mean depth of under 10 m (Whittock et al., 2016). To date there is no evidence indicating flatback turtles in deep offshore waters during the internesting period (Pendoley, 2019). There are BIAs for flatback turtle foraging and internesting within the EMBA (see Figure 3-15).

Green turtle

Green turtles (*Chelonia mydas*; Vulnerable under the EPBC Act; Migratory) are predominately found off the WA, NT and Queensland coastlines (CoA, 2017b). The green turtle is the most common marine turtle breeding in the NWMR, with WA supporting one of the largest remaining populations worldwide (DSEWPaC, 2012e). Green turtles

travel up to 3,100 km between nesting and feeding areas (Ferreira et al., 2021; DSEWPaC, 2012e) and forage on algae, seagrass and mangroves, including on offshore coral reefs across north-western Australia (Ferreira et al., 2021; CoA, 2017b).

In the NT, nesting sites occur mostly from the western end of Melville Island to near the Queensland border (NT Government, n.d). The Cobourg Peninsula green turtle genetic stock is the closest to those on the Tiwi Islands and they nest between October and April, with peak nesting period between December and January. Nesting in the Tiwi Islands includes the beaches within the EMBA on the south-west of Bathurst Island (Chatto & Baker, 2008; Pendoley, 2023). Nesting sites for the species in the Bonaparte or Van Diemen bioregions are Black/Smith Point and Lawson Island, east of the Tiwi Islands near Cobourg Peninsula (Chatto & Baker, 2008).

Green turtles are likely to be encountered within the EMBA, mainly within reef areas, and internesting is expected between October and April (CoA, 2017b). There are BIAs for green turtle foraging and internesting within the EMBA and critical habitat for green turtles are located in the waters of the EMBA (Figure 3-14).

Hawksbill turtle

Hawksbill turtles (*Eretmochelys imbricata*, Vulnerable under the EPBC Act and TPWC Act; Migratory) predominantly occur along northern Australian coastlines (WA, NT and Queensland), with 3 recognised stocks: north Queensland stock located in the north Great Barrier Reef and Torres Strait; north-east Arnhem Land stock in the NT; and WA stock located on the North West Shelf. Hawksbill turtles are omnivorous and feed on algae, sponges, soft corals and soft bodied invertebrates foraging in waters ranging from 1.5 to 84 m deep (Fossette et al., 2021). This species is typically associated with rocky and coral reef habitats, often returning to a small foraging area, and is expected to be found within these habitats along the WA coastline, from Shark Bay to the northern extent of the NWMR, migrating over 4,600 km from their nesting site (Crommenacker et al., 2022; Barr et al., 2021; CoA, 2017b). Unlike green turtles, there is little evidence that hawksbill turtles nesting elsewhere in WA, NT, or Queensland migrate to the Tiwi Islands to forage (Pendoley, 2023) and the islands are not listed as an important nesting, foraging, or internesting site for this species (CoA, 2017b).

In the NT, nesting occurs on islands concentrated around north-eastern Arnhem land and Groote Eylandt (NT Government, n.d) and is reported to occur from July to December (DSEWPaC, 2012e). Nesting on the Tiwi Islands has been recorded at Seagull Island and northern Melville Island (Chatto & Baker, 2008), outside the EMBA.

Hawksbill turtles may forage on banks and shoals within the EMBA, and BIAs for hawksbill turtle internesting overlap the waters of the EMBA (Figure 3-16).

Leatherback turtle

Leatherback turtles (*Dermochelys coriacea*; Endangered under the EPBC Act; Critically endangered under the TPWC Act; Migratory) are known to forage and migrate throughout the open offshore waters of Australia, with foraging more common along the east coast and Bass Strait. Leatherback turtles are pelagic throughout their life and feed almost exclusively on jellyfish. Records of leatherback turtles nesting in Australia are sparse, and limited to Queensland, NSW and NT (DCCEEW, 2024j; CoA, 2017b), with scattered isolated nesting (one to 3 nests per year) in Qld and the NT (Limpus & McLachlin, 1994). Due to the lack of significant nesting sites in Australian waters, leatherback turtles are likely migrants from neighbouring countries foraging in Australia (Limpus, 2009b). Habitat critical to the survival of the leatherback turtle (nesting) and leatherback turtle BIA for internesting intersects the EMBA near the Cobourg Peninsula (Figure 3-13).

Loggerhead turtle

Loggerhead turtles (*Caretta caretta*; Endangered under the EPBC Act; Vulnerable under the TPWC Act; Migratory) range along most of the Australian coastline and throughout the NWMR (CoA, 2017b). This species is carnivorous and mainly feeds on benthic invertebrates in a wide range of habitats from nearshore to waters 55 m deep (CoA, 2017b). Breeding aggregations occur on Australia's east (Queensland, NSW) and west coasts. Loggerhead turtles have one genetic breeding stock within WA, with approximately 3,000 females supporting the third-largest population in the world (CoA, 2017b; Limpus, 2008a; Baldwin et al., 2003).

Capable of large migrations, individual loggerhead turtles from both WA and eastern Australian have been recorded foraging in the NT, and further afield in Indonesia and Papua New Guinea (Perez et al., 2022; Pendoley, 2023). In the Kimberley region, loggerhead turtles are thought to be transient or end-of-migration foragers with no documented nesting sites in the area (Tucker et al., 2021). Although loggerhead turtles forage in the Oceanic Shoals Marine Park, the Arafura Sea and the Gulf of Carpentaria, they are not known to breed in the region. Loggerheads found within the EMBA most likely come from the WA population, nesting outside the EMBA (CoA, 2017b). A BIA for loggerhead turtle foraging intersects the EMBA (Figure 3-17).

Olive ridley turtle

Olive ridley turtles (*Lepidochelys olivacea*; Endangered under the EPBC Act; Vulnerable under the TPWC Act; Migratory) are known to nest in the NT and on western Cape York (Queensland), with low density nesting recorded on the Kimberley coast, in the Dampier Peninsula and along Camden Sound (Tucker et al., 2021; CoA, 2017b).

This species is primarily carnivorous and feeds on soft-bodied invertebrates in waters between 15 m and 200 m in depth. Olive ridley turtles migrate through oceanic waters, travelling up to 1,130 km between their nesting and foraging grounds (Cáceres-Farias et al., 2022; CoA, 2017b; Whiting et al., 2005). All reported olive ridley movements were largely restricted to within the 100 m depth contour (Pendoley, 2023).

Olive ridley turtles are known to nest on the Tiwi Islands on the west coast of Bathurst Island and the north coast of Melville Island. These turtles are part of the NT genetic stock, significant at both a national and international level (CoA, 2017b). The NT genetic stock nests throughout the year, with peaks between April and June, and most hatchlings emerge between June and August (CoA, 2017b).

Internesting habitat for this species encompasses nearshore waters along the north, west and east coasts of the Tiwi Islands. Tracking studies showed these turtles remain close to shore in waters less than 55 m deep within 37 km of the nesting beach during the internesting interval (Whiting et al., 2007; 2005). Migrating olive ridley turtles tracked from the Tiwi Islands typically moved in a north-east and west/south-westerly direction, to foraging grounds ~300–400 km to the west in the Joseph Bonaparte Gulf or up to 1,200 km away in the Arafura Sea and Gulf of Carpentaria (Pendoley, 2023). Olive ridley turtles may be encountered in the shallow waters of the Tiwi Islands, with BIAs for foraging, nesting and internesting intersecting the EMBA (Figure 3-12).

3.2.12.2.2 Crocodiles

The salt-water crocodile (*Crocodylus porosus*; Migratory) was listed under the EPBC Act to regulate commercial hunting which caused a significant decline in the population (DCCEEW, 2024j). Salt-water crocodiles are found across northern Australia and occur within the nearshore marine and estuarine waters of the Kimberley coast (DCCEEW, 2024j). Larger populations within the major river systems of the Kimberley occur in the rivers draining into the Cambridge Gulf, the Prince Regent and Roe River systems of the east and north-west Kimberley (DCCEEW, 2024j). The nesting habitat for this species predominantly occurs within the Ord, King and Roe River systems (DCCEEW, 2024j). There are no BIAs for the salt-water crocodile within the EMBA, but given their widespread distribution, they are likely to be present within the EMBA.

3.2.12.3 Sharks, rays and other fish

3.2.12.3.1 Sharks

Grey nurse shark

The grey nurse shark (*Carcharias taurus*; Vulnerable under the EPBC Act) has a wide but patchy tropical and temperate distribution in the Indo-West Pacific and Atlantic oceans. There are 2 distinct subpopulations in Australia on the east and west coast. The west coast population inhabits coastal and continental shelf waters from south-west WA (Albany) up to the North West Shelf (FRDC, 2019) and although one aggregation site has been documented, data on their distribution along the WA and NT coastline is lacking (Hoschke et al., 2023). Grey nurse sharks undertake large-scale movements to potentially capitalise on seasonal prey aggregations, with individuals migrating 1,294 km along the WA coast from SW WA to Ningaloo, and 1,500 km on the east coast (Dwyer et al., 2023; DCCEEW, 2024j; Jakobs et al., 2019). Grey nurse sharks are thought to move further north along the coast during May to December. Individuals have been caught near Browse Island and off Bali, Indonesia (Hoschke et al., 2023; Momigliano & Jaiteh, 2015). During the Barossa marine studies program, 4 grey nurse sharks were observed at seamounts in waters 130 m deep, one possibly pregnant (Jacobs, 2016). This was considered unusual as neither of the subpopulations are known to extend that far north and are generally associated with shallower, more coastal waters (DCCEEW, 2024j). Given grey nurse sharks have been observed at seamounts and oceanic coral reefs in the Timor Sea, the species may be present around reefs, banks and seamounts in the EMBA.

Mako sharks

Shortfin mako (*Isurus oxyrinchus*; Migratory) and longfin mako (*Isurus paucus*; Migratory) sharks are both highly migratory epipelagic species. The shortfin mako is a common shark in tropical and temperate waters above 16 °C (Groeneveld et al., 2014), and as such widespread throughout Australian waters except for the Torres Strait, Arafura Sea and Gulf of Carpentaria (FRDC 2019; Birkmanis et al., 2020; Kyne et al., 2021a). Shortfin mako sharks exhibit sexual and developmental segregation; juveniles spend 90% of their time near the surface whereas adults dive much deeper (Groeneveld et al., 2014). In contrast, the wide but patchy distribution and biology of the rarely encountered longfin mako is less well documented (Kyne et al., 2021a). This epipelagic shark also inhabits tropical and warm-temperature waters. In Australia, longfin mako sharks are found from Geraldton in WA across the NT and Queensland down to Port Stevens in NSW (FRDC, 2019; Rigby et al., 2019). These species may be rarely encountered within the EMBA.

Oceanic whitetip shark

The oceanic whitetip shark (*Carcharhinus longimanus*; Migratory) is a highly mobile globally widespread species found in tropical and warm temperate waters between 18 to 28°C from the surface to at least 180 m, venturing close to shore where the continental shelf is narrow (Kyne et al., 2021a). Within Australian waters, this rarely encountered species is found in warmer waters from Cape Leeuwin in WA across northern Australia down to

Sydney (Kyne et al., 2021a). Oceanic whitetip sharks have been globally assessed as Critically Endangered by the IUCN, Overfished by SAFS and listed on CITES Appendix II (FRDC, 2019). It is possible that individuals of this species may be encountered within the EMBA.

Northern river shark

Northern river sharks (*Glyphis garricki*; Endangered under the EPBC Act and TPWC Act) are rare and although their distribution is uncertain, they are known to occur in the Ord and King Rivers, King Sound and Joseph Bonaparte Gulf in WA, along with the South and East Alligator Rivers and the Wessel islands in NT (Udyawer et al., 2021; FRDC, 2019; DSEWPaC, 2010a). These sharks are thought to segregate during various life stages, occupying rivers, estuarine systems, macrotidal embayments as well as inshore marine habitats (Kyne et al., 2021a; FRDC, 2019; DSEWPaC, 2010a). Although the northern river shark has been recorded in offshore waters, the frequency of this occurrence is unknown.

The Sawfish and River Shark Multispecies Recovery Plan (CoA, 2015b) recorded observations of adults and juveniles in marine waters north of Derby, WA while pupping and juveniles occur in King Sound and Cambridge Gulf. Under the recovery plan, all aggregations and areas of biologically important behaviours such as breeding, foraging, resting or migrating are considered critical to the survival of the species. Individuals may be encountered in low numbers within the EMBA.

Speartooth shark

The speartooth shark (*Glyphis glyphis*; Critically endangered under the EPBC Act; Vulnerable under the TPWC Act) has been recorded as occurring in macrotidal rivers and estuary environments, with juveniles and sub-adults utilising large tropical river systems as their primary habitat (Kyne et al., 2021b; DSEWPaC, 2010b, Stevens et al., 2005). It is thought that their marine distribution may be limited to the coastal marine environment outside of rivers (Udyawer et al., 2021; FRDC, 2019; DSEWPaC, 2010b). While the speartooth shark is known to inhabit the Wenlock/Ducie/Port Musgrave river system in Qld and various rivers of the Van Diemen Gulf in the NT, new populations of this species were recently discovered in the Daly River, NT and the Ord River, WA (Kyne et al., 2021b). It has been recorded in tidal rivers and estuaries with turbid waters with fine muddy substrates in temperatures ranging from 27 to 33 °C (Pillans et al., 2009). Individuals may be encountered in low numbers within the EMBA.

Scalloped hammerhead shark

The scalloped hammerhead shark (*Sphyrna lewini*; conservation dependent under the EPBC Act) is a coastal and semi-oceanic species globally distributed in tropical and warm-temperate waters from the intertidal zone to at least 275 m in depth, with newborns found in coastal zones (Kyne et al., 2021a; FRDC, 2019). Recent studies suggest that the Indo-Pacific population (including Australia) is genetically distinct from the Atlantic and Caribbean populations. There is likely to be 2 subpopulations in Australian waters (WA and the rest of Australia), with the non-WA subpopulation connected to Papua New Guinea and Indonesia by shallow water habitats along northern Australia (Green et al., 2022). Across northern Australia, the pupping season peaks from October to January (TSSC, 2018). This mobile species has a broad Australian range from NSW and Qld across the NT to WA (Bartes et al., 2021; Kyne et al., 2021a; FRDC, 2019). Scalloped hammerhead sharks are known to occur within the EMBA.

White shark

The white shark (*Carcharodon carcharias*; Vulnerable under the EPBC Act, Migratory) is a rare, primarily temperate species with a wide Australian range and 2 subpopulations; eastern Australasia (from Papua New Guinea along Australia's east coast and Macquarie Island to the south-western Pacific, including waters off New Caledonia, Vanuatu and Tonga) and a southern-western population (from western Victoria across southern Australia and up the WA coast; DSEWPaC, 2013; FRDC, 2019; Kyne et al., 2021a). Although the species has been recorded south from central Queensland to up to Ningaloo Reef and may occur further north on both coasts, white sharks are not known to aggregate within the NWMR or NMR and are most likely to be found south of North West Cape (DSEWPaC, 2012a; 2012d). The reasons for movements to north-western WA are unknown and little information is available on their reproduction in Australian waters (McAuley et al., 2016; DSEWPaC, 2012d). White sharks are unlikely to be seen in the EMBA.

Whale shark

The whale shark (*Rhincodon typus*; Vulnerable under the EPBC Act, Migratory) is globally distributed in tropical and warm temperate seas, except the Mediterranean. There are 2 distinct subpopulations, with approximately 75% of the global population in the Indo-Pacific, and the remaining 25% in the Atlantic Ocean (Vignaud et al., 2014 in FRDC, 2019). Ningaloo Reef in WA is a known aggregation site, and whale sharks congregate off Christmas Island from December to January. These aggregations are thought to be linked to seasonal prey fluctuations (TSSC, 2015g). The species is an epipelagic filter feeder with a diet of planktonic and nektonic species, including small crustaceans and smaller schooling fish species (DCCEEW, 2024j). Whale sharks are known to be highly migratory with migrations of over 20,000 km recorded (Guzman et al., 2018). Migration along the northern WA coastline broadly follows the 200 m isobath and typically occurs between July and November (TSSC, 2015g).

Wilson et al. (2006) recorded 6 whale sharks departing Ningaloo Reef and traveling north-east into the Indian Ocean. Meekan and Radford (2010) showed that whale sharks migrated up the coast from Ningaloo Reef and individually dispersed over a broad area; either north-west into the open Indian Ocean, northward towards Sumatra and Java, or north-east towards the Timor Sea; and Thomson et al., (2021) more recently recorded whale sharks tagged in Ningaloo Reef traveling to the North West Shelf. Due to their widespread distribution, highly migratory whale sharks may occur within the EMBA.

3.2.12.3.2 Rays

Manta ray

The giant manta ray (*Mobula birostris*; Migratory) and reef manta ray (*Mobula alfredi*; Migratory) are globally distributed in both tropical and temperate waters. Giant manta rays are considered to be the more migratory and oceanic species of the 2, and individuals of this highly mobile species are not expected to be resident in Australian waters (Kyne et al., 2021a; Couturier et al., 2015). While considered more solitary and less frequently sighted than reef manta rays, giant manta rays can be found in large numbers engaging in foraging, mating or cleaning activities and exhibit seasonal habitat preferences frequenting offshore seamounts and islands (Marshall et al., 2022a).

The reef manta ray typically utilises productive nearshore habitats, including island groups, atolls and continental coastlines (Marshall et al., 2022b), and is coastally distributed across the north of Australia to approximately 30°S on both coasts (Armstrong et al., 2020). While reef manta rays demonstrate a high degree of site fidelity in tropical and subtropical waters, this species has also been shown to travel up to 700 km, undertake seasonal migrations and traverse international waters (Couturier et al., 2015). Reef manta rays are often sighted in high numbers, predominantly when undertaking foraging activities or migrating. There are no known foraging or breeding aggregation areas for these species within the EMBA. Based on the habitat preferences of these rays, it is unlikely that either species would occur in large numbers within the EMBA although individuals may transit through the area.

3.2.12.3.3 Sawfish

The 3 EPBC Act and TPWC Act listed threatened (Vulnerable) sawfish species that may occur in the EMBA, dwarf sawfish *(Pristis clavata)*, green sawfish *(Pristis zijsron)* and largetooth sawfish *(Pristis pristis),* occur mainly in inshore coastal waters and riverine environments in northern Australia. Adults of both green and largetooth sawfish are thought to use deepwater habitats, but this has not been confirmed for dwarf sawfish (DoE, 2015c). Considering the declining global populations of these sawfishes, northern and north-west Australia may contain the last significant populations of these species (Yan et al., 2021; DoE, 2015c; DSEWPaC, 2012d). Sawfishes feed on a variety of teleost fishes and benthic invertebrates, including cephalopods, crustaceans and molluscs (Lear et al., 2023; Thorburn et al., 2007; 2008; Pogonoski et al., 2002). Based on their habitat preferences, it is considered highly unlikely that these sawfish would occur within the deeper offshore waters of the EMBA. A fourth species, the narrow sawfish (Anoxypristis cuspidata; Migratory), is currently being assessed for EPBC threatened species listing (DoE, 2023g), and may be found within the EMBA.

Dwarf sawfish

The dwarf sawfish (*Pristis clavata*; Vulnerable under the EPBC Act and TPWC Act; Migratory) is primarily found in shallow coastal and estuarine areas, from Cairns in Queensland around the north of Australia to the Pilbara coastline in WA, with juveniles thought to remain in estuarine waters (FRDC, 2019; DEWHA, 2009).

Green sawfish

The green sawfish (*Pristis zijsron*; Vulnerable under the EPBC Act and TPWC Act; Migratory) is most common in shallow coastal and estuarine areas, but this species has been recorded in water depths of up to 70 m from Cairns, Queensland across to Broome, WA (FRDC, 2019; DEWHA, 2008a). Green sawfish appear to have limited tidally influenced movements, occupying only a few square kilometres within the coastal fringe, and strongly associated with mangroves and adjacent mudflats (Lear et al., 2023). Although their spatial and temporal distribution in these creeks is variable with changing tidal and environmental conditions, they typically return to inshore waters to breed and pup (Chevron, 2011).

Largetooth sawfish

The largetooth sawfish (*Pristis pristis*; Vulnerable under the EPBC Act; Migratory) inhabits the sandy or muddy bottoms of river, estuarine and marine environments within north-west Australia and has a patchy distribution including the Fitzroy, Durack, Robinson and Ord rivers in WA. Newborns and juveniles occur primarily in the freshwater areas of rivers and in estuaries, while adults mostly occupy marine and estuarine environments (FRDC, 2019; DSEWPaC, 2012d).

Narrow sawfish

The narrow sawfish (*Anoxypristis cuspidata*; Migratory), is currently being assessed for EPBC threatened species listing (DCCEEW, 2024j). Narrow sawfish are bentho-pelagic species found throughout the Indo-West Pacific and are still found throughout much of their historic range, albeit in substantially reduced numbers (FRDC, 2019).

Narrow sawfish occur across northern Australia from the Pilbara Coast in WA to Broad Sound in Queensland in waters up to 40 m deep on the continental shelf and in estuaries (Kyne et al., 2021a; FRDC, 2019). Juveniles and pupping females require inshore and estuarine habitats, while adults predominantly occur offshore (FRDC, 2019).

3.2.12.3.4 Other fish

The southern bluefin tuna (*Thunnus maccoyii*; conservation dependent – under threatened listing assessment, Migratory). Southern bluefin tuna are a highly migratory teleost fish species mainly found in the eastern Indian ocean and in the south-west Pacific ocean. With a varied diet including crustaceans, cephalopods, fishes and other marine animals, these fish can be found to depths of 500 m (Caton, 1991). Breeding takes place in tropical waters between Java, Indonesia, and northern WA (7 to 20°S) from September to April, and the young move down the WA coast from the spawning grounds (CCBST, 2023). Southern bluefin tuna school by size, with juveniles under two years of age found in WA and SA inshore waters (Honda et al., 2010). Adults inhabit offshore waters from northern WA across southern Australian, including Tasmania, to northern New South Wales

3.2.12.4 Birds

3.2.12.4.1 Threatened species

Alligator Rivers yellow chat

The Alligator Rivers yellow chat (*Epthianura crocea tunneyi;* Endangered under the EPBC Act and TPWC Act) is a small insectivorous bird that occurs mostly within the Kakadu National Park. The species' range and numbers are thought to have declined after habitat loss from cattle grazing, and habitat degradation caused by feral pigs and water buffalo. Its total population size is now very small, only around 100 individuals. (National Environmental Science Program Threatened Species Research Hub, 2019). Historically this species inhabits coastal grassy floodplains, however sightings have become rare and anecdotal. It is thought likely that there are small, undiscovered groups of chats, but that the overall population is still likely to be very small and to have suffered decline over time (National Environmental Science Program Threatened Species Research Hub, 2019). Given the areas historically observed to be inhabited by this species, it is unlikely to occur within the EMBA.

Asian dowitcher

The Asian dowitcher (*Limnodromus semipalmatus*; Vulnerable under the EPBC Act, Migratory) is a large, distinctive wader with a long neck, long legs, and a long, straight, snipe-like bill (DCCEEW, 2024j). In Australia, this bird is only a regular visitor to coastal areas between Broome and Port Hedland and the Port McArthur tidal wetlands in the Gulf of Carpentaria, arriving from August (DCCEEW, 2024f). It roosts in sheltered coastal environments such as estuarine and intertidal mudflats, lagoons, creeks and saltworks, and feeds on inter-tidal mudflats (DCCEEW, 2024f). Only a small proportion of the non-breeding population arrive in Australia, occasionally recorded in the NT and rarely in western and eastern Australia (DCCEEW, 2024j). In the NT, the Asian dowitcher is found in Darwin and Arnhem Land (DCCEEW, 2024j). No sites of international significance are listed in the NT for this species (Birdlife Australia, 2020). The Asian dowitcher typically leaves north-west Australia by the end of April to return to northern hemisphere breeding grounds (DCCEEW, 2024j; DCCEEW, 2024j). Given the areas historically observed to be inhabited by this species, individuals may seasonally occur within the EMBA.

Australian painted snipe

The Australian painted snipe (*Rostratula australis*; Endangered under the EPBC Act and TPWC Act) is a wading bird that has been recorded in wetlands of all Australian states, most frequently recorded in the Murray-Darling Basin and in smaller numbers and less frequently at scattered locations in WA and NT (DCCEEW, 2024j; DEPWS, 2021a). The most northerly breeding records are from near Derby and Taylor's Lagoon, near Broome and at Tarrabool Lake on the Barkly Tablelands. Although this species is only occasionally recorded in northern Australia, it has been recorded in northern WA and NT from McMinns Lagoon near Darwin and Yellow Waters in Kakadu (DCCEEW, 2024j; DEPWS, 2021a; Trainor et al., 2017; Knuckey et al., 2013). While this species generally inhabits shallow terrestrial freshwater and occasionally brackish wetlands and other waterlogged areas, the Australian painted snipe requires shallow wetlands with areas of bare wet mud and canopy cover nearby for breeding (DCCEEW, 2022a). Given the areas historically observed to be inhabited by this species—primarily inhabits freshwater wetlands—it is unlikely to occur in the EMBA.

Black-tailed godwit

Black-tailed godwits (*Limosa limosa*; Vulnerable under the EPBC Act, Migratory) are found in all states and territories of Australia during the non-breeding (austral summer) season, with coastal regions supporting the highest densities of the species. This bird usually first arrives in north-west Australia from late August and most have departed the NT by mid April (DCCEEW, 2024e). The largest populations are found on the north coast between Darwin and Weipa (DCCEEW, 2024e). Roosting usually occurs in sheltered bays, estuaries, and lagoons with large intertidal mudflats and/or sandflats. Feeding habitat includes areas of mud or soft, wet sand within sandflats, intertidal mudflats, saltmarshes, and the beaches of oceanic coastlines, bays, and estuaries (DCCEEW, 2024e). Areas of importance to the species in the NT include Darwin Harbour, North Darwin (the Beagle Gulf

coastline), Legune Wetlands and Milingimbi Coast, but none of these are considered to have international significance (Birdlife Australia, 2020). Given the areas historically observed to be inhabited by this species, individuals may seasonally occur within the coastline of the EMBA.

Common greenshank

The common greenshank (*Tringa nebularia*; Endangered under the EPBC Act, Migratory) is widespread in coastal regions, occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (DCCEEW, 2024h). The species is sparsely scattered through most of the NT (DCCEEW, 2024h), with important areas in the Kakadu National Park, Milingimbi coast, and the south-west coastline of the Gulf of Carpentaria, but no sites of international significance in the NT (Birdlife Australia, 2020). The common greenshank roosts around wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets (DCCEEW, 2024h). They occur in estuaries and mudflats, mangrove swamps and lagoons (DCCEEW, 2024h). During feeding, the birds pick from the surface (DCCEEW, 2024h) while wading in shallow water along the edge of tidal estuaries, muddy claypans, saltworks and saltpans (DCCEEW, 2024h). The species arrives in Australia from August, with most leaving by March and April, but some overwintering also occurs (DCCEEW, 2024h). Given the areas historically observed to be inhabited by this species, individuals may seasonally occur within the EMBA.

Curlew sandpiper

The curlew sandpiper (*Calidris ferruginea*; Critically Endangered under the EPBC Act and TPWC Act, Migratory) has a broad distribution and has been recorded along the coasts of all Australian states and territories (DCCEEW, 2024j). In NT, curlew sandpipers mostly occur around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove Peninsula, Groote Eylandt and Sir Edward Pellew Island (TSSC, 2015e). Although the species prefers intertidal mudflats in sheltered coastal areas to forage in nearshore waters or mud at the edge of wetlands, they are also widespread inland in smaller numbers (TSSC, 2015e). The curlew sandpiper migrates along the East Asian-Australasian Flyway from their breeding grounds in Siberia to Australia, generally arriving from late August/early September and departing by mid-April. Some non-breeding individuals may stay in Australia (TSSC, 2015e). Given the areas historically observed to be inhabited by this species, it may seasonally occur within the EMBA.

Eastern curlew

The eastern curlew (*Numenius madagascariensis*; Critically Endangered under the EPBC Act and TPWC Act, Migratory) is the world's largest species of shorebird (DCCEEW, 2024j; Menkhorst et al., 2017). Eastern curlews migrate annually to breeding grounds in Russia and north-eastern China before returning to Australia in August to forage primarily on crabs in intertidal mudflats (Menkhorst et al., 2017; Bamford et al., 2008). In Australia, the species has a continuous distribution from Barrow Island and Dampier Archipelago in WA through the Kimberley and along the NT, Qld, NSW coasts including the Torres Strait islands (TSSC, 2015f). There has been an increase at 2 sites in the Darwin region between 2009 and 2015, at Lee Point numbers have increased by 9% per year and 17% per year at East Arm Wharf in Darwin Harbour (Lilleyman et al., 2016). This local increase may be due to changes in roosting behaviour and an increase in suitable high tide roosting habitat. Given the areas historically observed to be inhabited by this species, it may seasonally occur within the EMBA.

Great knot

The great knot (*Calidris tenuirostris*; Vulnerable under the EPBC Act; Critically Endangered under the TPWC Act, Migratory) is a medium-sized migratory shorebird with relatively short legs, a slender medium-length bill and a wingspan of about 58 cm (DCCEEW, 2024d). The species breeds in north-east Siberia and far north-east Russia and migrates along the East Asia-Australasian Flyway to overwinter in the southern hemisphere (DEPWS, 2021c). Most that reach Australia settle along the northern coastline between north-west WA and the Gulf of Carpentaria, but significant numbers reach eastern Queensland and there are reports of great knots from most Australian coastal areas. The species is common in the NT from Darwin to the south-west Gulf of Carpentaria (DCCEEW, 2024d) with internationally significant numbers recorded in North Darwin (Beagle Gulf coastline) and the Milingimbi Coast (Birdlife Australia, 2020). It prefers sheltered coastal habitats with extensive tidal mudflats or sandflats, including estuaries, lagoons, inlets and bays. Great knots are gregarious and frequently occur in large flocks with other shorebirds (including red knots), especially when roosting during high tides. They specialise in feeding on bivalves, but also consume other marine invertebrates. Prey are captured on or just below the surface of wet mud or sand (Garnet et al., 2011, DEPWS, 2021c). Given the areas historically observed to be inhabited by this species, individual birds may fly over and feed in coastal zones within the EMBA.

Greater sand plover

Greater sand plovers (*Charadrius leschenaultia*, Vulnerable under the EPBC Act and TPWC Act, Migratory) are shorebirds that migrate from breeding areas in Mongolia, Siberia and China to coastal areas of all Australian states with the area around Darwin an internationally important site. This species occurs in the greatest numbers in north-western Australia and is widespread between Northwest Cape and Roebuck Bay in WA, with scattered records between Roebuck Bay and Darwin. Greater sand plovers are recorded from most of the coastline of the NT, with significant areas around the Joseph Bonaparte Gulf, from Anson Bay to Murgenella Creek (including the south

coast of the Tiwi Islands), the northern Arnhem coast, and the Port McArthur area (TSSC, 2016). In Australia, greater sand plovers are almost entirely coastal, inhabiting sheltered muddy, sandy or shelly beaches, large intertidal mudflats, saltmarshes, estuaries, sandbanks, coral reefs, rocky islands rock platforms, tidal lagoons and coastal dunes. Greater sand plovers feed on molluscs, worms, crustaceans and insects they find in wet sand or mud on open intertidal flats (TSSC, 2016). Given the areas historically observed to be inhabited by this species, individuals may fly over and be present within the EMBA.

Grey Falcon

Grey falcon (*Falco hypoleucos*; Vulnerable under the EPBC Act and TPWC Act; Migratory) occur throughout much of the arid and semi-arid zones of Australia, in areas of sparsely timbered lowland plains, typically on inland drainage systems. The species has been recorded across the NT, including on the Tiwi Islands (DEPWS, 2021i). Grey Falcons use nests built by other bird species and prefer those in the tallest trees along watercourses. The Grey Falcon is a specialist predator of birds, particularly parrots and pigeons (TSSC, 2020). Given the areas historically observed to be inhabited by this species, it is considered unlikely to be present within the EMBA.

Grey plover

Grey plovers (*Pluvialis squatarola;* Vulnerable under the EPBC Act; Migratory) have been recorded along the coast in all states of Australia, with small numbers regularly recorded in the NT (DCCEEW, 2024g). Migrating birds arrive in northern Australia between August and October with many continuing their migration to southern regions. Plovers which have remained along the northern coastline for the non-breeding season leave between February and April (DCCEEW, 2024g). Some non-breeding individuals may stay in Australia. The species usually roosts in sheltered, sandy areas including unvegetated sandbanks or sand-spits, or other sheltered environments such as estuaries or lagoons, and are often seen in small numbers on mangrove mudflats (DCCEEW, 2024g). Kakadu National Park, Milingimbi coast, and the south-west coastline of the Gulf of Carpentaria have been identified as areas of importance to this species in the NT, but they do not represent sites of international significance (Birdlife Australia, 2020). In Australia, grey plovers feed by pecking and probing for worms, molluscs, and crustaceans mostly in mud or soft, wet sand of sandflats, intertidal mudflats, saltmarshes, and beaches (DCCEEW, 2024g). Given the areas historically observed to be inhabited by this species, individuals may seasonally fly over and be present in coastal zones within the EMBA.

Lesser sand plover

The lesser sand plover (*Charadrius mongolus*: Endangered under the EPBC Act and TPWC Act; Migratory) is a small to medium sized shorebird with a short stout bill and short grey legs. The lesser sand plover breeds in central Asia and eastern Russia. Two subspecies occur in Australia as seasonal migrants: *Charadrius mongolus mongolus* and *Charadrius mongolus. stegmanni*. In Australia, *Charadrius mongolus stegmanni* is more common in northern Australia, while *Charadrius mongolus. mongolus* is more common in eastern Australia (DEPWS, 2021d). After breeding during the northern summer on mountain steppes and tundras of inland eastern Russia (*Charadrius mongolus. mongolus*) or sand dunes, shingle and other open habitats of eastern Siberia (*Charadrius mongolus. stegmanni*), those that overwinter in Australia migrate southwards along the East Asian-Australasian Flyway. These non-breeding birds occur almost exclusively along the coast, where they forage on sheltered intertidal mudflats and sandflats, sandy beaches, estuaries and mangroves. Inland saline wetlands close to the coast are also used occasionally. They feed on marine worms, molluscs, crustaceans and insects, which are captured on or just below the surface of sand or mud. Given the areas historically observed to be inhabited by this species, individuals may fly over and feed in coastal zones within the EMBA.

Bar-tailed godwit (Western Alaskan, Nunivak and Northern Siberian subspecies)

The bar-tailed godwit (*Limosa lapponica*; Endangered under the EPBC Act; Critically Endangered under the TPWC Act; Migratory) breeds in the northern hemisphere and migrates southwards for the boreal winter. The majority of breeding individuals leave south-eastern Australia by the end of the first week of April, with mostly immature individuals remaining (Bamford et al., 2008). This species has been recorded along the coastline of all Australian states and mainly occurs along Australia's north and east coasts. This species is widespread from Eyre to Derby in WA and from Darwin east to the Gulf of Carpentaria (DCCEEW, 2024j; Clarke, 2011). Bar-tailed godwits eat molluscs, worms, crustaceans and insects caught when foraging in shallow water or along the edge of water with a preference for exposed sandy or soft mud substrates on intertidal flats, banks and beaches (Chan et al., 2022; TSSC, 2016a). Given the areas historically observed to be inhabited by this species, individuals may fly over and feed in coastal zones within the EMBA.

Masked Owl (northern)

Masked owl (northern) (*Tyto novaehollandiae kimberli;* Vulnerable under the EPBC Act and TPWC Act) is distributed widely across northern Australia in tall open eucalypt forests (DEPWS, 2021e). The masked owl (northern) roosts in monsoon rainforests, and also forages in more open vegetation types, including grasslands. Individuals typically roost in tree hollows and may also roost among dense foliage (DCCEEW, 2024j). The diet of the masked owl (northern mainland) mostly comprises mammals up to the size of possums (Garnett & Crowley

2000). Due to their habitat and prey preferences, and their restriction to the Tiwi Islands, it is unlikely that they will be present within the EMBA.

Partridge pigeon (eastern)

Partridge pigeon (eastern) (*Geophaps smithii smithii;* Vulnerable under the EPBC Act and TPWC Act) occur across northern Australia in lowland eucalypt open forests and woodlands, with grassy understoreys. Their diet comprises seeds, mostly of grasses but also from Acacia and other woody plants. The species forages entirely on the ground, and flies infrequently (DEPWS, 2021i). Due to their habitat and diet preferences, it is unlikely that they will be present within the EMBA.

Red goshawk

The red goshawk (*Erythrotriorchis radiatus*; Vulnerable under the EPBC Act and TPWC Act) occur across northern Australia, from near Broome in the south-west Kimberley to south-eastern Queensland. Within this range it generally occurs in taller forests characteristic of higher rainfall areas, but there are some isolated recent records from central Australia. It appears to be unusually common on the Tiwi Islands (DEPWS, 2021g). The preferred habitat is tall open eucalypt forest and riparian areas (including paperbark forest and gallery forests). The conspicuous basket–shaped stick nest is typically placed in large trees near watercourses (Aumann and Baker-Gabb, 1991). Red goshawks eat mostly birds, especially parrots and pigeons; rarely they also prey on mammals, reptiles, and large insects (Debus et al., 2020). Given the areas historically observed to be inhabited by this species, individuals may fly over and feed in coastal zones within the EMBA.

Red knot

The red knot (*Calidris canutus*; Vulnerable under the EPBC Act; Endangered under the TPWC Act, Migratory) is a migratory omnivorous shorebird which utilises the intertidal mudflats, sandflats and sandy beaches of sheltered coastal areas, estuaries, bays and other similar marine habitats (DCCEEW, 2024c). The red knot is present throughout coastal and offshore Australia, with large numbers regularly recorded in the north-west of Australia (Clarke, 2011; Bamford et al., 2008). The red knot breeds in Siberia and spends the non-breeding season in Australia and New Zealand, arriving in northern Australia in late August to early September and also settles in eastern Australia and New Zealand (DCCEEW, 2024c; Watkins, 1993). During the non-breeding season, the red knot occurs on tidal mudflats or sandflats feeding on invertebrates, especially shellfish (Garnet et al., 2011). Both north-western and south-eastern Australia are key areas for red knots. The Gulf of Carpentaria is an important staging area for migrating birds headed to south-eastern Australia and New Zealand. The NT region between the Daly River and Bynoe Harbour, along with the northern Arnhem Land coast from Boucaut Bay to Buckingham Bay are important areas (Chatto, 2003), with North Darwin (Beagle Gulf coastline) considered to have international significance (Birdlife Australia, 2020). Given the areas historically observed to be inhabited by this species, individuals may fly over and feed in coastal zones within the EMBA.

Ruddy turnstone

The ruddy turnstone (*Arenaria interpres*; Vulnerable under the EPBC Act, Migratory) is a migratory shorebird that leaves its breeding grounds in the northern hemisphere from mid-July to early September (DCCEEW, 2024a) and has an almost cosmopolitan non-breeding distribution, common throughout Australasia and widespread within Australia (DCCEEW, 2024a). This species tends to arrive in the NT and WA from August onwards (DCCEEW, 2024a). Ruddy turnstones typically roost along platforms and shelves of rock, shingle, or gravel beaches, but can also be found along sand, coral, or shell beaches, and along shoals, cays, and dry ridges. In north Australia, they are known to occur in a wide variety of habitats and may prefer wide mudflats (DCCEEW, 2024a). The species feeds mainly on maggots from rotting seaweed in the upper intertidal (DCCEEW, 2024a). Bynoe Harbour and Castlereagh Bay in the NT are reported to be important areas (DCCEEW, 2024a) with the Milingimbi Coast considered to have international significance for this bird (Birdlife Australia, 2020). Given the areas historically observed to be inhabited by this species, individuals may seasonally fly over and be present in coastal zones within the EMBA.

Sharp-tailed sandpiper

The sharp tailed sandpiper (*Calidris acuminata*; Vulnerable under the EPBC Act, Migratory) is a small-medium size wader that is widely distributed throughout Australia (DCCEEW, 2024j). The majority (>90%) of the non-breeding population migrates to Australia (DCCEEW, 2024b). They arrive in Australia from mid-August/early September with most birds then moving slowly south to south-east Australia (DCCEEW, 2024j). In the NT, the species mostly occurs in the northern coastal regions (DCCEEW, 2024j), with Darwin Harbour, North Darwin (Beagle Gulf coastline), Kakadu National Park, the Legune Wetlands, Milingimbi coast and Nhulunbuy (Gove Peninsula) considered to be important areas (Birdlife Australia, 2020). Internationally significant numbers have been recorded at Kakadu National Park and Milingimbi coast (Birdlife Australia, 2020). Sharp tailed sandpipers often roost at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse grass or saltmarsh, but also occasionally on sandy beaches, stony shores or rocks (DCCEEW, 2024j). They typically feed on seeds, worms, molluscs, crustaceans and insects (DCCEEW, 2024j), foraging at the edge of the water of wetlands or intertidal

mudflats, either on bare wet mud or sand, or in shallow water (DCCEEW, 2024j). Given the areas historically observed to be inhabited by this species, individuals may fly over and feed in coastal zones within the EMBA.

Terek sandpiper

The terek sandpiper (*Xenus cinereus*; Vulnerable under the EPBC Act, Migratory) is primarily a coastal species, more common in northern and eastern parts of Australia than southern regions (DCCEEW, 2024j). It is one of the commoner shorebird species in tropical mangrove-lined estuaries, often occurring in small numbers among much larger flocks of other migratory shorebirds (DCCEEW, 2024i). They feed primarily on crustaceans and insects, in the supralittoral or upper littoral zone, where a film of water covers the sand, but may also forage in the lower littoral zone on exposed rock platforms (DCCEEW, 2024i). In the NT, widespread records occur from Darwin, north to Melville Island, and east to the western section of the Gulf of Carpentaria, around Gove Peninsula, Groote Eylandt, Sir Edward Pellew Island and the mouth of the McArthur River (DCCEEW, 2024j). Important areas are considered to include Darwin Harbour, North Darwin (Beagle Gulf coastline), Kakadu National Park, the Legune Wetlands and Milingimbi Coast, with the Kakadu and Milingimbi Coast identified to have international significance (Birdlife Australia, 2020). The preferred roosting habitat for this bird is in or among mangroves (DCCEEW, 2024j). Terek sandpipers migrate south from their Arctic breeding grounds, passing through the Torres Strait and arriving around Cairns and Darwin in August. Most individuals visiting Australia seem to remain on the north coast, leaving by late April (DCCEEW, 2024i). This species is likely to seasonally occur in the EMBA.

Tiwi Islands hooded robin

The Tiwi Islands hooded robin (*Melanodryas cucullata melvillensis,* Critically Endangered under the EPBC Act and TPWC Act) distribution is restricted to the Tiwi Islands. Tiwi Islands hooded robin inhabit more open forests and woodlands and forages on ground-dwelling invertebrates in areas of thinner ground-cover (DEPWS, 2021b). The breeding season (of other subspecies) is spring–summer. The nests are typically placed in the forks of trees, mostly <3 m above ground. The typical foraging behaviour of Tiwi Islands hooded robin is by quietly perching on tree branches, or trunks, and then suddenly pouncing to take prey on the ground (Fitri & Ford 2003; Higgins & Peter 2002). Due to their habitat and prey preferences, and their restriction to the Tiwi Islands, it is unlikely that they will be present within the EMBA.

Tiwi masked owl

The Tiwi masked owl (*Tyto novaehollandiae melvillensis*; Endangered under the EPBC Act and TPWC Act) is a subspecies of the masked owl (*Tyto novaehollandiae*) that occurs only on Bathurst and Melville Islands. Tiwi masked owls occur mainly in the forests and woodlands but may roost in monsoon forests or mangroves and may forage over the treeless plains and grasslands (Ward, 2010). Individuals typically roost in tree hollows but may also roost among dense foliage. Masked Owls breed in large tree hollows, which usually form in large rainforest trees. It is likely that individual home ranges are large. The diet of the Tiwi Masked Owl mostly comprises mammals up to the size of possums (DEPWS, 2021f). Due to their habitat and prey preferences, and their restriction to the Tiwi Islands, it is unlikely that they will be present within the EMBA.

3.2.12.4.2 Migratory species

Most migrant birds are expected to fly over the regional area as part of their large-scale transitory movements and are unlikely to land on the sea for significant periods of time (ConocoPhillips, 2018). Considering this, and the general absence of landing areas at a regional offshore scale, the majority of seabird activity is likely to comprise foraging and migration pathways. While seabirds spend much of their lives at sea, migratory shorebirds overfly offshore areas during migratory periods and typically do not interact with the sea surface (ConocoPhillips, 2018; DSEWPaC, 2012g). Migratory wetland species do not interact with open offshore waters but may land on offshore infrastructure while flying between land masses (ConocoPhillips, 2018).

Shorebird migration patterns are seasonal and vary according to species (DSEWPaC, 2012h), but generally shorebirds migrate to northern Australia from August to November. The majority of birds remain in northern Australia, while others disperse southwards (Bennelongia, 2011). On northern beaches migratory shorebirds peak in November then again in March as the majority of birds begin their return to the northern hemisphere between March and May. Most migratory shorebirds do not breed in Australia and juvenile birds may spend several years in Australia before reaching maturity and returning north to breed (DEWHA, 2008c). Species listed as migratory under the EPBC Act that may occur in the EMBA are outlined in Table 3-12.

Table 3-12: Environmental values and sensitivities within the EMBA and OA – threatened and migratory marine fauna

Value/sensitivity – Marine fauna		EPBC Act status	NT-listed threatened Species	OA		MEVA		EMBA	
Common name	Scientific name			May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities
Marine mammals									
Blue whale[6]	*Balaenoptera musculus*	Endangered, Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Bryde's whale	*Balaenoptera edeni*	Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area
Fin whale	*Balaenoptera physalus*	Vulnerable, Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Humpback whale	*Megaptera novaeangliae*	Migratory Marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Killer whale, orca	*Orcinus orca*	Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Sei whale	*Balaenoptera borealis*	Vulnerable, Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Australian humpback dolphin	*Sousa sahulensis*	Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Australian snubfin dolphin	*Orcaella heinsohni*	Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area
Spotted bottlenose dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus* (Arafura/Timor Sea populations)	Migratory Marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Dugong[7]	*Dugong dugon*	Migratory Marine	✗	✗	Not applicable (N/A)	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Water Mouse	*Xeromys myoides*	Vulnerable	✗	✗	N/A	✗	N/A	✓	Species or species habitat likely to occur within area
Marine reptiles									
Flatback turtle	*Natator depressus*	Vulnerable, Migratory Marine	✗	✓	Congregation or aggregation known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Green turtle	*Chelonia mydas*	Vulnerable, Migratory Marine	✗	✓	Congregation or aggregation known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable, Migratory Marine	Vulnerable	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area
Leatherback turtle	*Dermochelys coriacea*	Endangered, Migratory Marine	Critically endangered	✓	Species or species habitat likely to occur within area	✓	Breeding likely to occur within area	✓	Foraging, feeding or related behaviour known to occur within area
Loggerhead turtle	*Caretta caretta*	Endangered, Migratory Marine	Vulnerable	✓	Species or species habitat known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area	✓	Foraging, feeding or related behaviour known to occur within area
Olive ridley turtle	*Lepidochelys olivacea*	Endangered, Migratory Marine	Vulnerable	✓	Congregation or aggregation known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Salt-water crocodile	*Crocodylus porosus*	Migratory marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Sharks, rays and other fish									
Dwarf sawfish[9]	*Pristis clavata*	Vulnerable, Migratory marine	Vulnerable	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area

[6] *In Australian waters there are two subspecies of blue whale, the pygmy blue whale (B. m. brevicauda) and the Antarctic blue whale (B. m. intermedia). It is more likely that the pygmy blue whale could be encountered within the EMBA.*

[7] *Species or species habitat may occur within the light / noise boundary (20 km buffer around the OA)*

Value/sensitivity – Marine fauna		EPBC Act status	NT-listed threatened Species	OA		MEVA		EMBA	
Common name	Scientific name			May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities
Giant manta ray[9]	*Mobula birostris*	Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Green sawfish[9]	*Pristis zijsron*	Vulnerable, Migratory marine	Vulnerable	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Grey nurse shark	*Carcharias taurus*	Vulnerable	✗	✓	Reported as occurring within or near the OA as part of the Barossa marine studies program.	✓	Reported as occurring within or near the OA as part of the Barossa marine studies program.	✓	Reported as occurring within or near the OA as part of the Barossa marine studies program.
Largetooth sawfish[9]	*Pristis pristis*	Vulnerable, Migratory marine	Vulnerable	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area
Longfin mako[9]	*Isurus paucus*	Migratory marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Narrow sawfish[9]	*Anoxypristis cuspidata*	Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Northern river shark	*Glyphis garricki*	Endangered	Endangered	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Oceanic whitetip shark[9]	*Carcharhinus longimanus*	Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Reef manta ray[9]	*Mobula alfredi*	Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Scalloped hammerhead	*Sphyrna lewini*	Conservation dependent	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area
Shortfin mako[9]	*Isurus oxyrinchus*	Migratory marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Southern Bluefin Tuna	*Thunnus maccoyii*	Conservation dependent	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Speartooth shark	*Glyphis glyphis*	Critically endangered	Vulnerable	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Whale shark[9]	*Rhincodon typus*	Vulnerable, Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
White shark[9]	*Carcharodon carcharias*	Vulnerable, Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Birds									
Common noddy	*Anous stolidus*	Migratory marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Common sandpiper	*Actitis hypoleucos*	Migratory wetlands	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Curlew sandpiper	*Calidris ferruginea*	Critically endangered, Migratory wetlands, Overfly Marine	Critically endangered	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Eastern curlew	*Numenius madagascariensis*	Critically endangered, Migratory wetlands, Marine	Critically endangered	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Great frigatebird	*Fregata minor*	Migratory marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Lesser frigatebird	*Fregata ariel*	Migratory marine	✗	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Pectoral sandpiper	*Calidris melanotos*	Migratory wetlands	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Red knot, knot	*Calidris canutus*	Vulnerable, migratory wetlands, Overfly marine	Endangered	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area

Value/sensitivity – Marine fauna		EPBC Act status	NT-listed threatened Species	OA		MEVA		EMBA	
Common name	Scientific name			May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities
Sharp-tailed sandpiper	*Calidris acuminata*	Vulnerable, Migratory wetlands	✗	✓	Species or species habitat may occur within area	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Streaked shearwater	*Calonectris leucomelas*	Migratory Marine	✗	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
White-tailed tropicbird	*Phaethon lepturus*	Migratory Marine	✗	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Alligator Rivers yellow chat	*Epthianura crocea tunneyi*	Endangered	Endangered	✗	N/A	✓	Species or species habitat may occur within area		Species or species habitat likely to occur within area
Asian dowitcher	*Limnodromus semipalmatus*	Vulnerable, Migratory Wetlands, Overfly marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Australian painted snipe	*Rostratula australis*	Endangered, Overfly Marine	Endangered	✗	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Barn swallow	*Hirundo rustica*	Migratory Terrestrial, Overfly Marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Bar-tailed godwit	*Limosa lapponica*	Endangered, Migratory Wetlands	Critically endangered	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Black-tailed godwit	*Limosa limosa*	Vulnerable, Migratory Wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Broad-billed sandpiper	*Limicola falcinellus*	Migratory Wetlands, Overfly Marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Common greenshank	*Tringa nebularia*	Endangered, Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Fork-tailed swift	*Apus pacificus*	Migratory marine, Overfly marine	✗	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Great knot	*Calidris tenuirostris*	Vulnerable, Migratory Wetlands, Overfly Marine	Critically endangered	✗	N/A	□	Roosting known to occur within area	✓	Roosting known to occur within area
Greater crested tern	*Thalasseus bergii*	Migratory wetlands	✗	✗	N/A	✗	N/A	✓	Breeding likely to occur within area
Greater sand plover	*Charadrius leschenaultii*	Vulnerable, Migratory wetlands, Marine	Vulnerable	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Grey falcon	*Falco hypoleucos*	Vulnerable, Migratory wetlands, Marine	Vulnerable	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area
Grey plover	*Pluvialis squatarola*	Vulnerable, Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Grey-tailed tattler	*Tringa brevipes*	Migratory wetlands,	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Lesser sand plover	*Charadrius mongolus*	Endangered, Migratory wetlands	Endangered	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Little curlew	*Numenius minutus*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Little ringed plover	*Charadrius dubius*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Little tern	*Sternula albifrons*	Migratory marine	✗	✗	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area
Long-toed stint	*Calidris subminuta*	Migratory wetlands, Overfly arine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Marsh sandpiper	*Tringa stagnatilis*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area

Value/sensitivity – Marine fauna		EPBC Act status	NT-listed threatened Species	OA		MEVA		EMBA	
Common name	Scientific name			May be present	Particular values or sensitivities	May be present	Particular values or sensitivities	May be present	Particular values or sensitivities
Masked owl (northern)	*Tyto novaehollandiae kimberli*	Vulnerable	Vulnerable	✗	N/A	✓	Species or species habitat likely to occur within area		Species or species habitat known to occur within area
Nunivak bar-tailed godwit, Western Alaskan bar-tailed godwit	*Limosa lapponica baueri*	Vulnerable	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Oriental cuckoo, horsfield's cuckoo	*Cuculus optatus*	Migratory terrestrial	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Oriental plover, oriental dotterel	*Charadrius veredus*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Oriental pratincole	*Glareola maldivarum*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Oriental reed-warbler	*Acrocephalus orientalis*	Migratory wetlands	✗	✗	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area
Osprey	*Pandion haliaetus*	Migratory wetlands	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area
Pacific golden plover	*Pluvialis fulva*	Migratory wetlands	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Partridge pigeon (eastern)	*Geophaps smithii smithii*	Vulnerable	Vulnerable	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Pin-tailed snipe	*Gallinago stenura*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting likely to occur within area	✓	Roosting likely to occur within area
Red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Vulnerable	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Red-necked stint	*Calidris ruficollis*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Red-rumped swallow	*Cecropis daurica*	Migratory terrestrial, Overfly marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Ruddy turnstone	*Arenaria interpres*	Vulnerable, Migratory wetlands	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Rufous fantail	*Rhipidura rufifrons*	Migratory terrestrial, Overfly marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Sanderling	*Calidris alba*	Migratory wetlands	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Swinhoe's snipe	*Gallinago megala*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Terek sandpiper	*Xenus cinereus*	Vulnerable, Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Tiwi Islands hooded robin	*Melanodryas cucullata melvillensis*	Critically Endangered	Critically Endangered	✗	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area
Tiwi masked owl	*Tyto novaehollandiae melvillensis*	Endangered	Endangered	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area
Wandering tattler	*Tringa incana*	Migratory wetlands	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Whimbrel	*Numenius phaeopus*	Migratory wetlands	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Wood sandpiper	*Tringa glareola*	Migratory wetlands, Overfly marine	✗	✗	N/A	✓	Roosting known to occur within area	✓	Roosting known to occur within area
Yellow wagtail	*Motacilla flava*	Migratory terrestrial, Overfly marine	✗	✗	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area

3.2.12.5 Biologically important areas and habitat critical to the survival of a species

BIAs and habitat critical to the survival of a species that overlap the OA and EMBA are listed in Table 3-13 and shown in Figure 3-11 to Figure 3-18. BIAs are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, nesting, internesting or migration. Habitat critical to the survival of marine turtles provides areas for turtle activities, long-term maintenance of the species, maintain genetic diversity and long-term evolutionary development and re-introduction of populations or recovery of the species.

Table 3-13: Biologically important areas and habitat critical to the survival of a species identified within the EMBA

Species	BIA behaviour	Distance to OA (km)	MEVA	EMBA	Habitat critical to the survival of a species within EMBA and distance to OA
Marine Mammals					
Australian snubfin dolphin	Breeding	73	×	✓	×
Australian humpback dolphin	Breeding	46	✓	✓	×
Spotted bottlenose dolphin	Breeding	73	×	✓	×
Marine Turtles					
Flatback turtle	Foraging	192	×	✓	✓ Overlaps OA, MEVA and EMBA (nesting August–September)
	Internesting	Overlaps	✓	✓	
	Internesting buffer	265	×	✓	
Green turtle	Foraging	84	×	✓	✓ 231 km; Overlaps EMBA (nesting December–January)
	Internesting	84	×	✓	
Hawksbill turtle	Internesting	214	×	✓	×
Loggerhead turtle	Foraging	192	×	✓	×
Leatherback turtle	Internesting	254	×	✓	✓ 185 km (nesting December–January)
Olive ridley turtle	Foraging	71	✓	✓	✓ 4 km; Overlaps MEVA and EMBA (nesting May–July)
	Internesting	37	✓	✓	
Birds					
Bridled tern	Breeding	249	×	✓	×
Crested tern	Breeding	244	×	✓	×
	Breeding (high numbers)	86	×	✓	

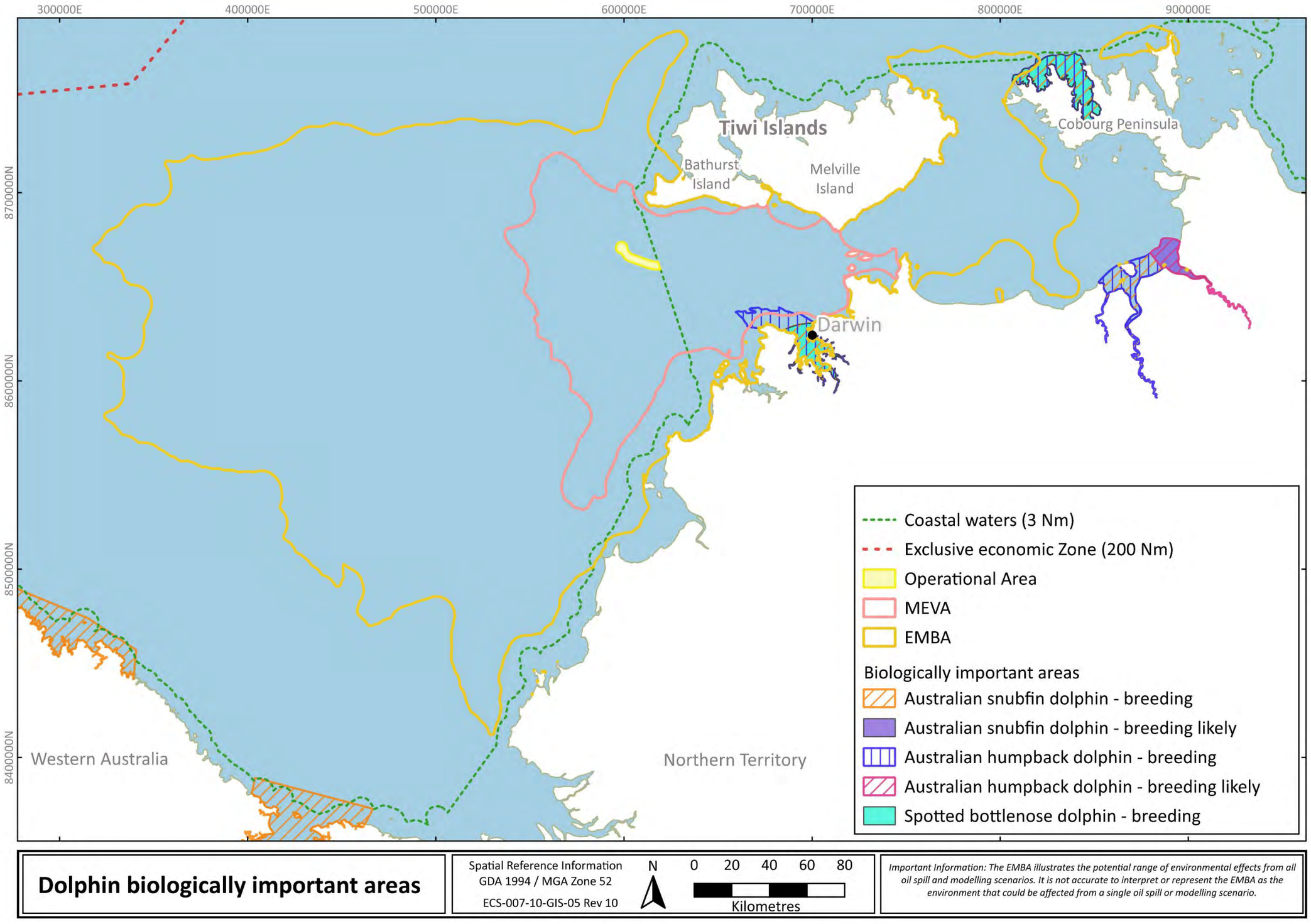


Figure 3-11: Dolphin BIAs overlapping or proximal to the EMBA

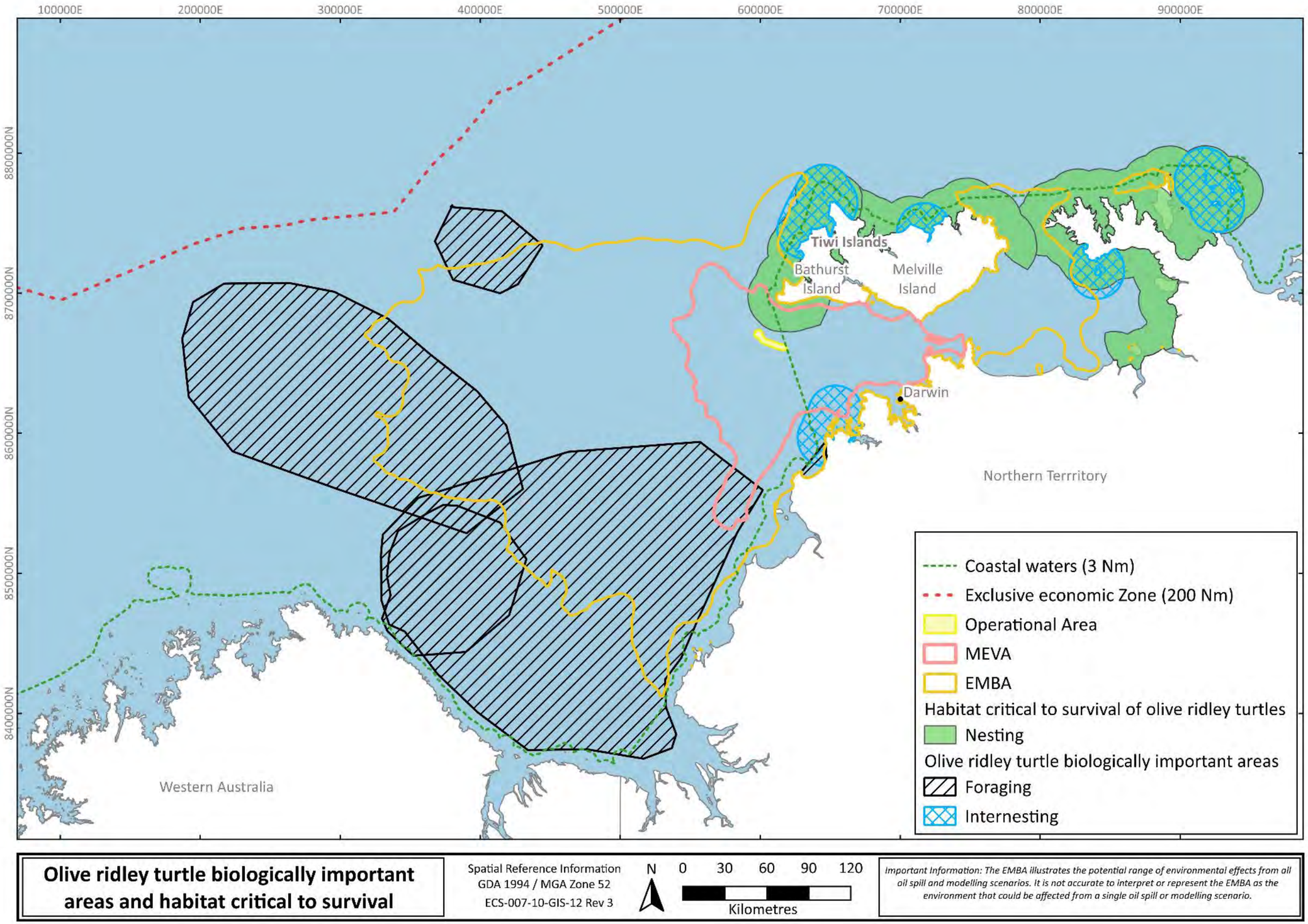


Figure 3-12: Olive ridley turtle BIAs and habitat critical to the survival of olive ridley turtles overlapping or proximal to the EMBA

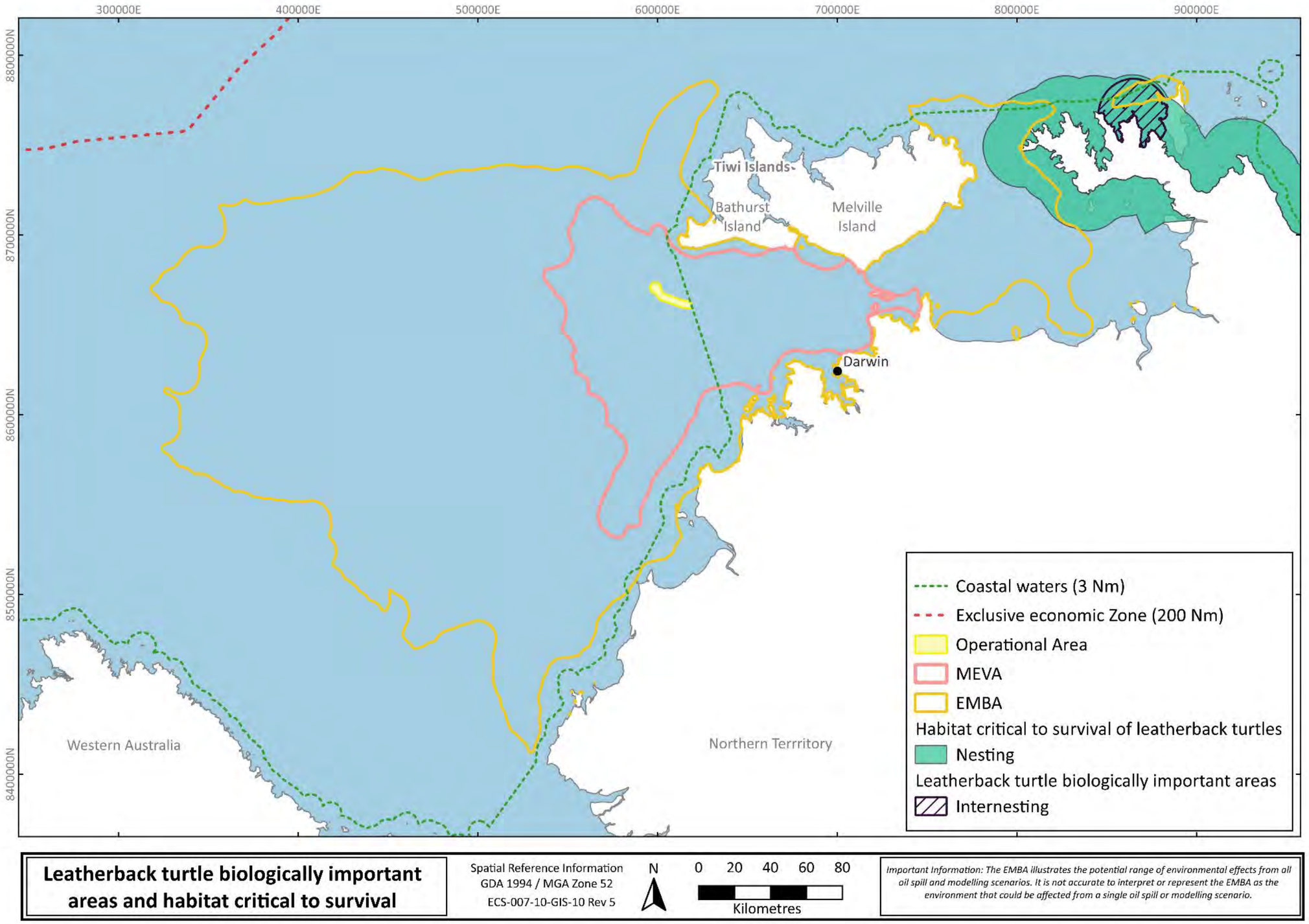


Figure 3-13: Leatherback turtle BIAs and survival of leatherback turtles overlapping or proximal to the EMBA

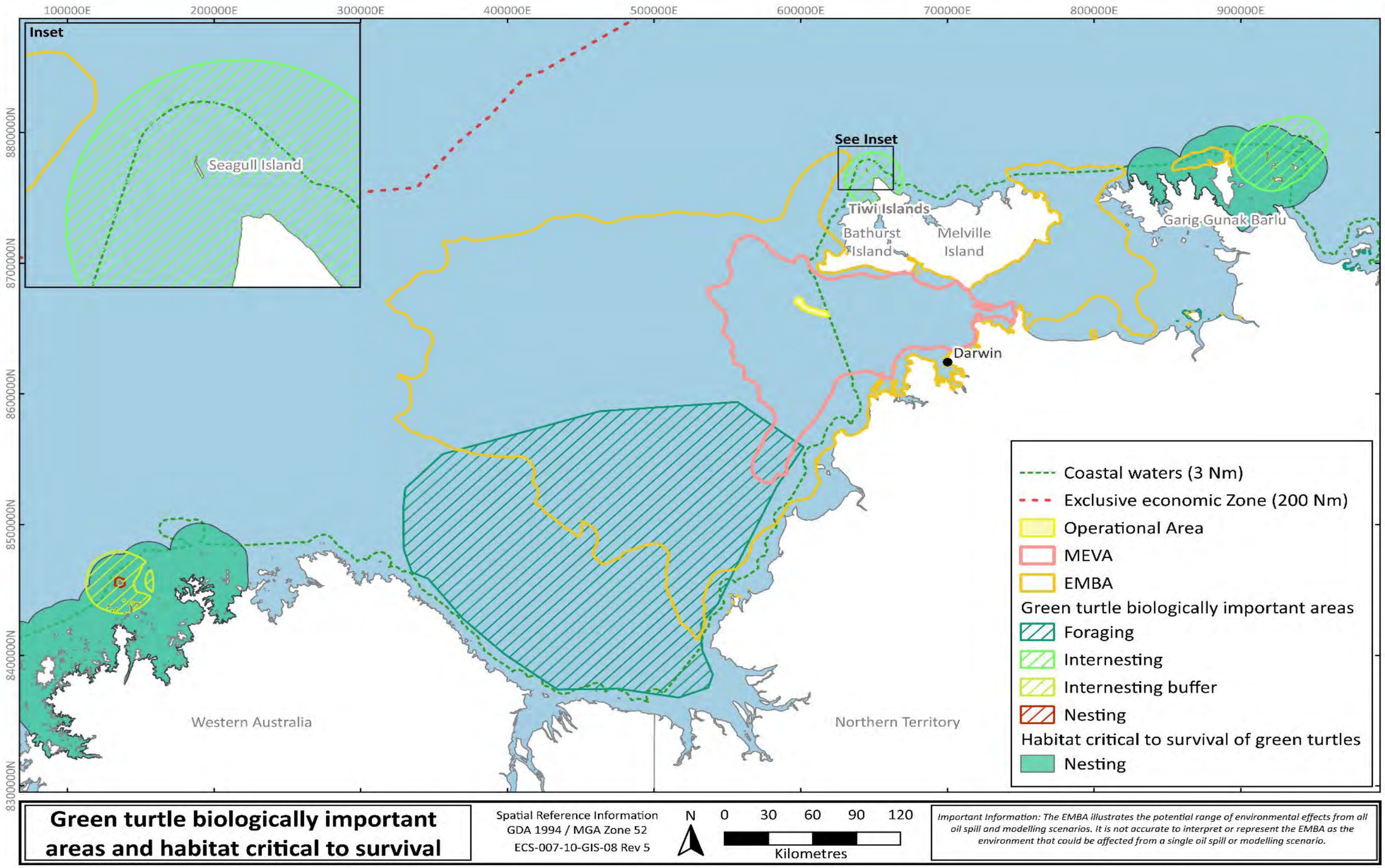


Figure 3-14: Green turtle BIAs and survival of green turtle overlapping or proximal to the EMBA

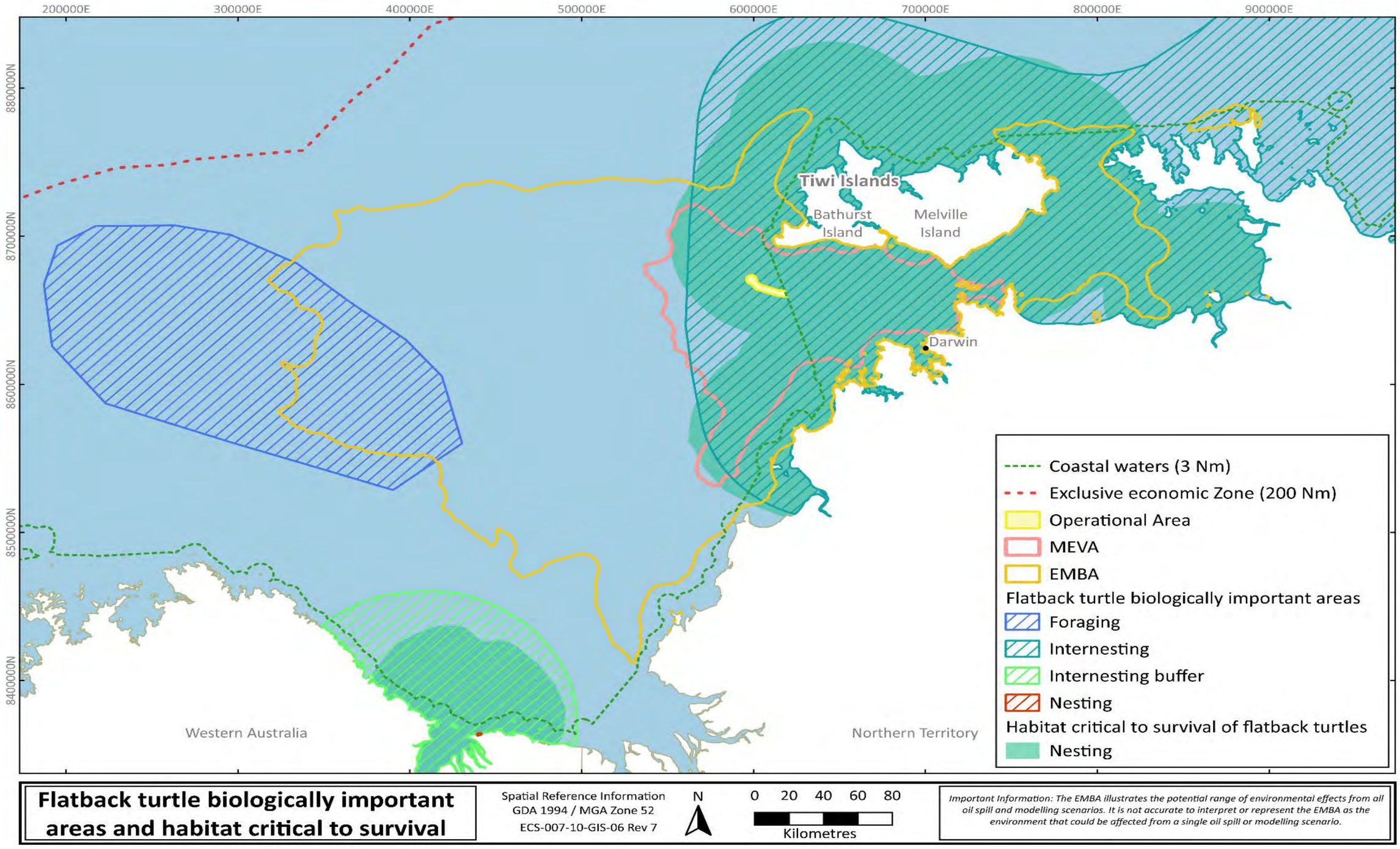


Figure 3-15: Flatback turtle BIAs and habitat critical to the survival of flatback turtles overlapping or proximal to the EMBA

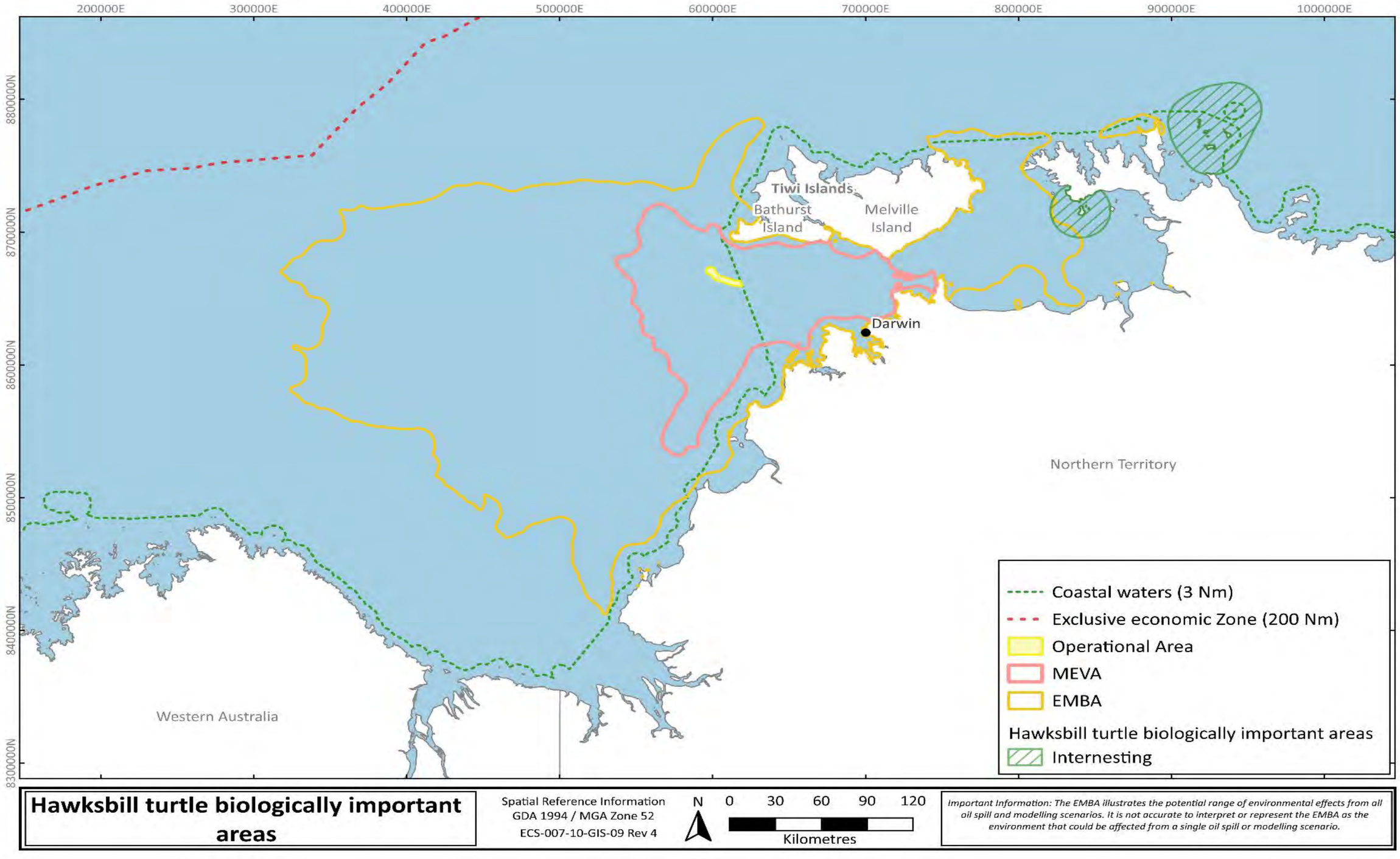


Figure 3-16: Hawksbill turtle BIAs overlapping or proximal to the EMBA

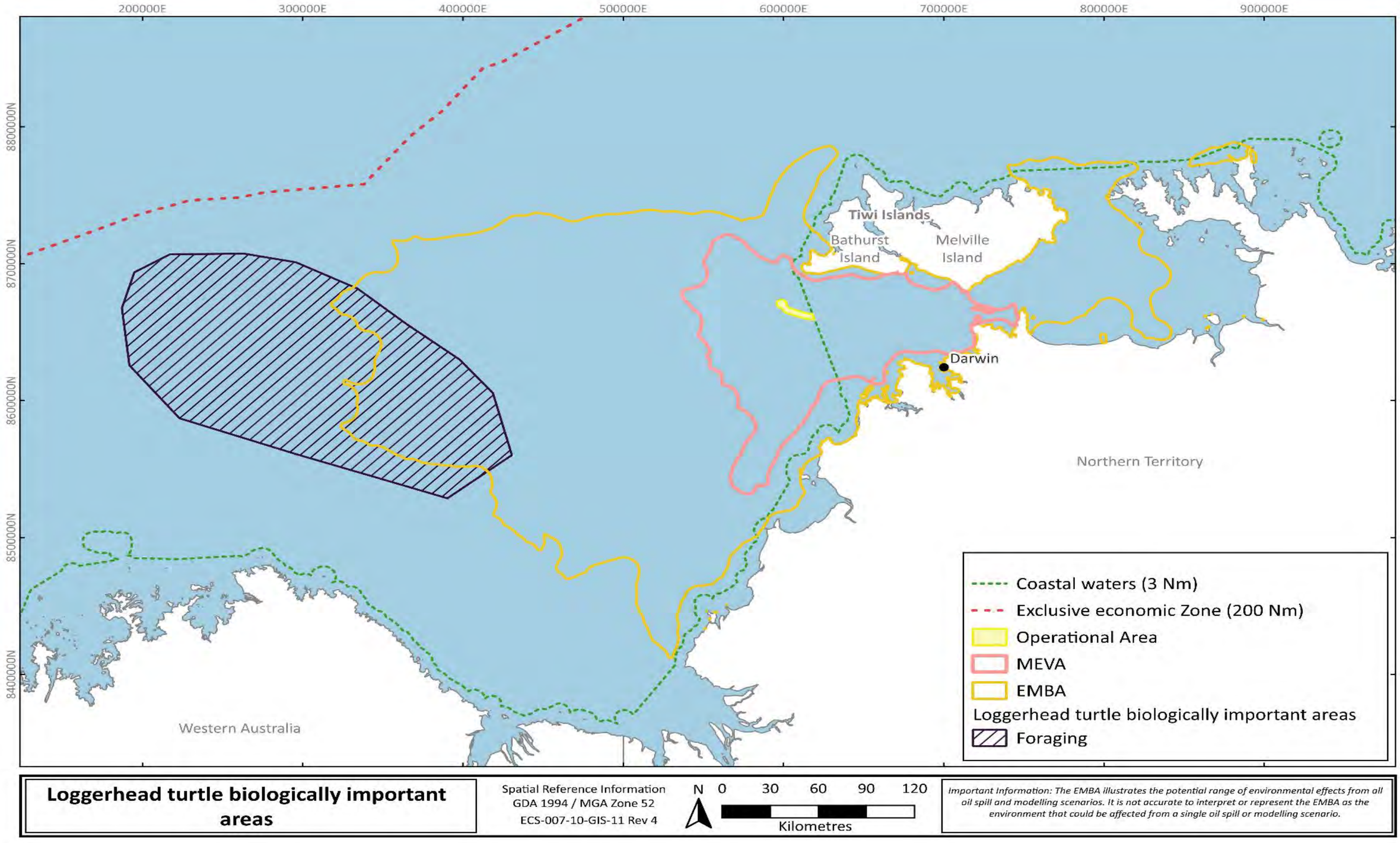


Figure 3-17: Loggerhead turtle BIAs overlapping or proximal to the EMBA

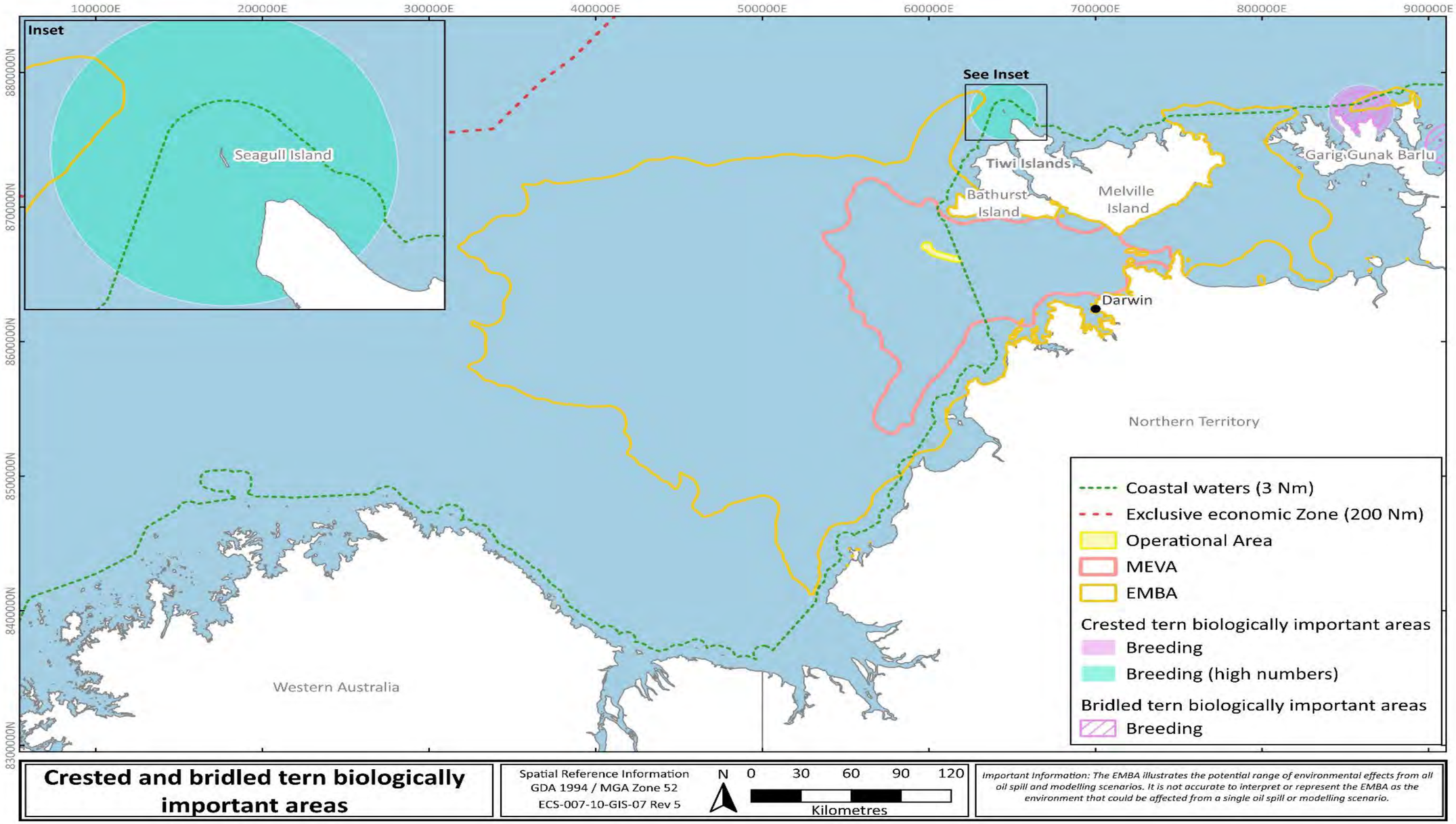


Figure 3-18: Seabird BIAs overlapping the EMBA

3.2.12.6 Conservation advice, recovery plans and management plans

Table 3-14 summarises the conservation actions relevant to the Activity and includes more information on the requirements of the applicable plans of management for those species (including conservation advice, recovery plans and management plans for marine fauna), and lists the sections in this EP where those management requirements are considered.

Table 3-14: Relevant threats and conservation actions identified in recovery plans, conservation advice and management plans for species that occur or may occur within the OA and EMBA

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
All					
All vertebrate fauna	Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018)	There are 4 main objectives: • contribute to the long-term prevention of the incidence of harmful marine debris • remove existing harmful marine debris from the marine environment • mitigate the impacts of harmful marine debris on marine species and ecological communities • monitor the quantities, origins and impacts of marine debris and assess the effectiveness of management arrangements over time for the strategic reduction of debris.	Marine debris	No explicit management actions for non–fisheries-related industries (note that management actions in the plan relate largely to managing fishing waste (e.g. 'ghost' gear), and state, territory and Commonwealth management through regulation).	7.1
Fish and sharks					
All sawfish and river sharks including: • dwarf sawfish • green sawfish • largetooth sawfish • speartooth shark • northern river shark	Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b)	The primary objective of this recovery plan is to assist the recovery of sawfish and river sharks with a view to: • improving the population status leading to the removal of the sawfish and river shark species from the threatened species list of the EPBC Act • ensuring that anthropogenic activities do not hinder recovery in the near future, or impact the conservation status of the species in the future. The specific objectives of the recovery plan (relevant to industry) are: • Objective 5: Reduce and, where possible, eliminate adverse impacts of habitat degradation and modification on sawfish and river shark species • Objective 6: Reduce and, where possible, eliminate any adverse impacts of marine debris on sawfish and river shark species noting the linkages with the Threat Abatement Plan for the impact of marine debris on vertebrate marine life (DoEE, 2018).	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	7.6, 7.7
Dwarf sawfish	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009)	No explicit relevant objectives.	Habitat degradation and modification	No explicit management actions for industry.	7.6, 7.7
Largetooth sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (TSSC, 2014b)	No explicit relevant objectives.	Habitat degradation and modification	Implement measures to reduce adverse impacts of habitat degradation and/or modification.	7.6, 7.7
Green sawfish	Approved Conservation Advice for Green Sawfish (DEWHA, 2008a)	No explicit relevant objectives.	Habitat degradation and modification	No explicit relevant management actions.	7.6, 7.7
Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC, 2014a)	No explicit relevant objectives.	Habitat degradation and modification	Implement measures to reduce adverse impacts of habitat degradation and/or modification.	7.6, 7.7
			Marine debris	No explicit relevant management actions.	7.1
Speartooth shark	Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014)	No explicit relevant objectives.	Habitat degradation and modification	Implement measures to reduce adverse impacts of habitat degradation and/or modification.	7.6, 7.7
			Marine debris	No explicit management actions for industry (note that the responsibility for the action identified is for Commonwealth Government to implement).	7.1
Grey nurse shark (west coast population)	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a)	The overarching objective of this recovery plan is to assist the recovery of the grey nurse shark in the wild with a view to: • improving the population status • ensuring that anthropogenic activities do not hinder the recovery of the grey nurse shark.	Pollution and disease	Review and assess the potential threat of introduced species, pathogens and pollutants.	6.6, 6.7, 7.2, 7.4, 7.6, 7.7
			Ecosystem effects as a result of habitat modification	Review the level and spatial extent of protection measures at key aggregation sites to ensure appropriate levels of protection, and a consistent approach to the designation and implementation of protective measures, are applied. Use BIAs to help inform the development of appropriate conservation measures, including applying advice in the marine bioregional plans on the types of actions that are likely to have	7.6, 7.7

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
				a significant impact on the species and updating such conservation measures as new information becomes available.	
White shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013)	The overarching objective of this recovery plan is to assist the recovery of the white shark in the wild throughout its range with a view to: • improving the population status leading to future removal of the white shark from the threatened species list of the EPBC Act • ensuring that anthropogenic activities do not hinder recovery in the near future, or impact the conservation status of the species in the future. The specific objective of the recovery plan (relevant to industry) is: • Objective 7: Continue to identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas.	Ecosystem effects as a result of habitat modification	No explicit relevant management actions.	7.6, 7.7
Whale shark	Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g)	To maintain existing levels of protection for the whale shark in Australia while working to increase the level of protection afforded to the whale shark within the Indian Ocean and Southeast Asian region to enable population growth so that the species can be removed from the threatened species list of the EPBC Act.	Boat strike from large vessels	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations along the northward migration route that follows the northern WA coastline along the 200 m isobath (TSSC, 2015g).	7.3
			Habitat disruption from mineral exploration, production and transportation	Implement measures to reduce adverse impacts of habitat degradation and/or modification.	7.6, 7.7
			Marine debris	No explicit relevant management actions.	7.1
Marine mammals					
Cetaceans and other marine megafauna	National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2017)	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna. The specific objective of the strategy (relevant to industry) is: • Objective 3: Mitigation – reduce the likelihood and severity of megafauna vessel collision.	Vessel collision	Encourage innovation and collaboration between research organisations and industry.	7.3
Blue whale (includes pygmy blue whale)	Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a)	The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the blue whale to improve so that it can be removed from the threatened species list under the EPBC Act.	Noise interference assess and address anthropogenic noise	Assess and address anthropogenic noise: shipping, industrial and seismic noise.	6.3
			Habitat modification	No explicit relevant management actions.	7.6, 7.7
			Vessel disturbance	Minimise vessel collisions: • develop a national vessel strike strategy that investigates the risk of vessel strike on blue whales and also identifies potential mitigation measures • ensure all vessel strike incidents are reported in the National Ship Strike database[8] • ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented.	7.3
			Marine debris	No explicit relevant management actions.	7.1
Fin whale	Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c)	Determine population abundance, trends and population structure for fin whales, and establish a long-term monitoring program.	Habitat degradation including pollution (increasing port expansion and coastal development)	No explicit relevant management actions.	6.6, 6.7, 7.4, 7.6, 7.7
			Anthropogenic noise	Once the spatial and temporal distribution (including BIAs) of fin whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).	6.3

[8] https://data.marinemammals.gov.au/report/shipstrike/new

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
			Vessel strike	Develop a national vessel strike strategy that investigates the risk of vessel strikes on fin whales and identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Ship Strike database[8].	7.3
Sei whale	Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b)	Determine population abundance, trends and population structure for sei whales, and establish a long-term monitoring program.	Anthropogenic noise	Once the spatial and temporal distribution (including BIAs) of sei whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).	6.3
			Vessel strike	Minimise vessel collisions: • develop a national vessel strike strategy that investigates the risk of vessel strikes on sei whales and also identifies potential mitigation measures • ensure all vessel strike incidents are reported in the National Ship Strike database[8].	7.3
			Habitat degradation including pollution	No explicit relevant management actions.	6.6, 6.7, 7.4, 7.6, 7.7
Water Mouse[9]	Conservation Advice for *Xeromys myoides* (Water Mouse) (DAWE, 2021)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	N/A
Reptiles					
All marine turtles (flatback, green, hawksbill, leatherback, loggerhead, olive ridley)	National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark, either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates these design principles: • start with natural darkness and only add light for specific purposes • use adaptive light controls to manage light timing, intensity and colour • light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill • use the lowest intensity lighting appropriate for the task • use non-reflective, dark-coloured surfaces • use lights with reduced or filtered blue, violet and ultraviolet wavelengths.	6.4
	Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b)	Long-term recovery objective: • minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: • anthropogenic threats are demonstrably minimised.	Marine debris	Reduce the impacts from marine debris: • support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (DoEE, 2018).	7.1
			Chemical and terrestrial discharge	Minimise chemical and terrestrial discharge.	6.6, 6.7, 7.4, 7.6, 7.7
			Vessel disturbance	Vessel interactions identified as a threat. No specific management actions in relation to vessels prescribed in the plan.	7.3
			Light pollution	Minimise light pollution: • manage artificial light within or adjacent to habitat critical to the survival of marine turtles such that marine turtles are not displaced from these habitats • develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches. • identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.	6.4

[9] *Species or species habitat is not known to be present in the OA. Hence, some threats typically relevant to petroleum activities (such as debris) have been assessed as not relevant and are not discussed further in this EP.*

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
			Noise interference	Assess and address anthropogenic noise: • understand the impacts of anthropogenic noise on marine turtle behaviour and biology.	6.3
			Habitat modification	Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to their survival. Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue.	7.6, 7.7
Leatherback turtle	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b)	No explicit relevant objectives.	Boat strike	No explicit relevant management actions.	7.3
			Habitat degradation (changes to breeding sites and degradation to foraging areas)	Identify and protect migratory corridors between nesting beaches and common foraging areas to facilitate colonisation.	7.6, 7.7
			Marine debris	No explicit relevant management actions.	7.1
Seabirds and shorebirds					
All seabirds and shorebirds	National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b)	Lighting objectives will need to consider the regulatory requirements and Australian standards relevant to the activity, location and wildlife present. Objectives should be described in terms of specific locations and times for which artificial light is necessary. Consideration should be given to whether colour differentiation is required and if some areas should remain dark, either to contrast with lit areas or to avoid light spill. Where relevant, wildlife requirements should form part of the lighting objectives. A lighting installation will be deemed a success if it meets the lighting objectives (including wildlife needs) and areas of interest can be seen by humans clearly, easily, safely and without discomfort.	Light pollution	Best practice lighting design incorporates these design principles: • start with natural darkness and only add light for specific purposes • use adaptive light controls to manage light timing, intensity and colour. • light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. • use the lowest intensity lighting appropriate for the task. • use non-reflective, dark-coloured surfaces. • use lights with reduced or filtered blue, violet and ultraviolet wavelengths.	6.4
Bridled tern Common noddy Great frigatebird Greater crested tern Lesser frigatebird Little tern Osprey Streaked shearwater Wedge-tailed shearwater White-tailed tropicbird	Wildlife Conservation Plan for Seabirds (CoA, 2020)	Seabirds and their habitats are protected and managed in Australia.	Pollution (marine debris, light, water)	Enhance contingency plans to prevent and/or respond to environmental emergencies that impact seabirds and their habitats.	6.4, 6.6, 7.1, 7.6, 7.7
			Habitat loss and degradation from pollution	No explicit relevant management actions.	7.6, 7.7
			Anthropogenic disturbance	Ensure all areas of important habitat for seabirds are considered in the development assessment process. Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.	7.3
Asian dowitcher Bar-tailed godwit Black-tailed godwit Common greenshank Curlew sandpiper Eastern curlew Great knot Greater sand plover Grey plover Lesser sand plover Little curlew Little ringed plover Long-toed stint	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c)	Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.	Habitat degradation/modification	No explicit relevant management actions.	7.6, 7.7
			Anthropogenic disturbance	Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia. Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes (specifically for coastal developments).	7.3
			Pollution/contamination	No explicit relevant management actions.	6.6, 7.4, 7.6, 7.7

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
Marsh sandpiper Oriental plover Pacific golden plover Pectoral sandpiper Red knot Red-necked stint Ruddy turnstone Sanderling Sharp-tailed sandpiper Streaked shearwater Terek sandpiper Whimbrel					
Asian dowitcher[10]	Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f)	No explicit relevant objectives.	Pollution/contamination	No explicit relevant management actions.	7.6, 7.7
Australian Painted Snipe[10]	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (TSSC, 2013)	No explicit relevant objectives.	Habitat loss, degradation and modification	No explicit relevant management actions.	7.6, 7.7
	National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (DCCEEW, 2022a)	No explicit relevant objectives.	Habitat loss, degradation and modification	No explicit relevant management actions.	7.6, 7.7
Black-tailed godwit[10]	Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	7.6, 7.7
Common greenshank[10]	Conservation Advice for *Tringa nebularia* (common greenshank) (DCCEEW, 2024h)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	7.6, 7.7
Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (TSSC, 2015e)	No explicit relevant objectives.	Habitat loss and degradation from pollution	No explicit relevant management actions.	7.6, 7.7
Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015f)	Australian objectives: • achieve a stable or increasing population. • maintain and enhance important habitat. • reduce disturbance at key roosting and feeding sites.	Habitat loss and degradation from pollution	No explicit relevant management actions.	6.6, 7.4, 7.6, 7.7
			Pollution/contamination	No explicit relevant management actions.	N/A
Great knot[10]	Conservation Advice for *Calidris tenuirostri*s (great knot) (DCCEEW, 2024d)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	7.6, 7.7
Greater sand plover[10]	Conservation Advice *Charadrius leschenaultii* (Greater sand plover) (TSSC, 2016)	No explicit relevant objectives.	Habitat loss and degradation	No explicit relevant management actions.	7.6, 7.7
			Pollution/contamination	No explicit relevant management actions.	N/A
Grey falcon[10]	Conservation Advice *Falco hypoleucos* (Grey Falcon) (TSSC, 2020)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	7.6, 7.7
Grey plover[10]	Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	7.6, 7.7
Lesser Sand Plover, Mongolian Plover[10]	Conservation Advice *Charadrius mongolus* (Lesser Sand Plover, Mongolian Plover) (TSSC, 2016d)	No explicit relevant objectives.	Habitat loss and degradation	No explicit relevant management actions.	7.6, 7.7
			Pollution/contamination	No explicit relevant management actions.	N/A
Partridge Pigeon (eastern)[10]	Conservation Advice *Geophaps smithii smithii (Partridge Pigeon [eastern])* (TSSC, 2015)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	N/A
Masked Owl (northern)[10]	Conservation Advice *Tyto novaehollandiae kimberli* (masked owl [northern]) (TSSC, 2015a)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	7.6, 7.7
		No explicit relevant objectives.	Habitat loss and degradation	Protect important habitat in Australia.	7.6, 7.7

[10] *Species or species habitat is not known to be present within planned impact areas (e.g. OA and light assessment boundary), or threats identified are not relevant to the Activity. Therefore, conservation advice or recovery is not evaluated within Section 6 or Sections 7.1–7.5 and 7.8.*

Name	Recovery plan/conservation advice/management plan	Relevant objectives	Threats/strategies identified as relevant to the Activity	Relevant conservation actions	Addressed (where relevant) in EP
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit[10]	Conservation Advice *Limosa lapponica baueri* (Bar-tailed godwit [western Alaska]) (TSSC, 2016a)		Pollution/contamination	Protect important habitat in Australia.	N/A
Red Goshawk[10]	Conservation Advice *Erythrotriorchis radiatus* (Red goshawk) (TSSC, 2015h)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	6.6, 7.4, 7.6, 7.7
Red knot	Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c)	No explicit relevant objectives.	Pollution/contamination impacts	No explicit relevant management actions.	7.6, 7.7
			Habitat loss and degradation	No explicit relevant management actions.	7.3
			Anthropogenic disturbance	No explicit relevant management actions.	7.6, 7.7
Ruddy turnstone[10]	Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024a)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	6.6, 7.4, 7.6, 7.7
Sharp-tailed sandpiper	Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	7.6, 7.7
Terek sandpiper[10]	Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i)	No explicit relevant objectives.	Pollution	No explicit relevant management actions.	N/A
Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands)[10]	Conservation Advice *Melanodryas cucullata melvillensis* (hooded robin [Tiwi Islands]) (TSSC, 2018a)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	N/A
Tiwi Masked Owl, Tiwi Islands Masked Owl[10]	Conservation Advice Tyto *novaehollandiae melvillensis* (masked owl [Tiwi Islands]) (TSSC, 2015i)	No explicit relevant objectives.	No explicit relevant threats	No explicit relevant management actions.	7.6, 7.7

3.2.13 Socioeconomic receptors

Socioeconomic activities that may occur in the OA and EMBA are set out in this section and summarised in Table 3-15. The broader cultural features are addressed in Section 3.2.6.

The OA is located within, and the EMBA overlaps, the Commonwealth marine area, which includes any part of the sea, including the waters, seabed and airspace, within the EEZ and extended continental shelf of Australia, that is not state or territory waters or coastal waters the rights in respect of which have been vested in a state or territory (Figure 3-2). The Commonwealth marine area stretches from 3 to 200 Nm from the coast.

Table 3-15: Socioeconomic-related activities that occur or may occur in the OA and EMBA

Value/sensitivity	OA presence	EMBA presence
Commercial fisheries – Commonwealth (see Section 3.2.13.1)	Commonwealth-managed fisheries that overlap the OA (see Figure 3-19 and Table 3-16): • Northern Prawn Fishery • Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery	Commonwealth-managed fisheries that overlap the EMBA are described in Table 3-16 and shown Figure 3-19.
Commercial fisheries – state/territory (see Section 3.2.13.1)	NT-managed fisheries that overlap the OA (see Figure 3-20 and Table 3-16): • Aquarium Fishery • Coastal Line Fishery • Demersal Fishery • Offshore Net and Line Fishery • Spanish Mackerel Fishery	NT- and WA-managed fisheries that overlap the EMBA are described in Table 3-16 and shown in Figure 3-20 and Figure 3-21.
Energy industry (see Section 3.2.13.2)	Within the OA, there are no established petroleum operations, however there are 2 existing pipelines within the vicinity—Bayu-Undan (greater than 0.1 km from the OA) and Ichthys (46.5 km from the OA).	The nearest offshore operating facility is the Santos-operated Bayu–Undan platform, approximately 375 km west of the OA. Oil and gas exploration permits are operated by other titleholders throughout the EMBA.
Telecommunications cables (see Section 3.2.13.4)	The North-West Cable System is located within the OA and approximately 2.5 km north of the PLET.	This cable system intersects the EMBA though a hydrocarbon spill will not have any impact on submarine cables.
Defence (see Section 3.2.13.3)	The OA intersects a designated defence practice area. During their surveillance, Australian Border Force vessels may transit the OA.	The EMBA intersects the practice and training areas of the North Australian exercise area and Darwin air weapons range (Figure 3-22). During their surveillance, Australian Border Force vessels may transit the EMBA.
Shipping (see Section 3.2.13.5)	The closest major commercial port to the OA is Darwin Port, 95 km away. No designated shipping channels intersect the OA.	Vessel traffic is expected within the EMBA. In 2020–2021, there were 1,416 vessel calls to Darwin port (Landbridge Darwin Port, 2021) (Figure 3-23).
Recreation and tourism (see Section 3.2.13.6)	The OA is located in offshore waters that are highly unlikely to be accessed for tourism activities (e.g. recreational fishing and boating and charter boat operations). These activities tend to be centred around nearshore waters, islands and coastal areas.	There are several offshore shoals, banks, coral reefs, shipwrecks within the EMBA. These areas may be visited by recreational fishers, fishing charter vessels, scuba diving, snorkelling and other charter vessels. The Tiwi Islands are a popular tourist destination offering cruises, fishing, sailing and water tours among other cultural activities. Scuba diving, snorkelling and other charter vessels are also a significant tourist attraction, with operators visiting the numerous shipwrecks, coral reefs and artificial reefs and embarking on day or multiday trips out to offshore islands and shoals.
Underwater cultural heritage (see Section 3.2.13.7)	There are no recorded UCH sites within the OA.	There are multiple sites protected under *Underwater Cultural Heritage Act 2018* (Cth) (UCH Act) and *Heritage Act 2011* (NT). Multiple known and unknown locations of shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur or may occur within the EMBA (Figure 3-24).

3.2.13.1 Commercial fisheries

The NWMR and NMR support Commonwealth–, NT– and WA–managed commercial fisheries that target various shark, demersal and pelagic finfish, molluscs, pearl oyster and crustacean species of commercial importance. Marine aquaculture (mariculture) within the EMBA is mostly associated with pearl oyster (*Pinctada maxima*) production in NT waters, which is focused in 4 main areas (NT Government, 2023):

- Bynoe Harbour
- Beagle Gulf
- Cobourg Peninsula and Croker Island
- around the islands north-west of Nhulunbuy.

The NT Government, via the Darwin Aquaculture Centre, is also encouraging the development of aquaculture of other species, including barramundi, sea cucumber, blacklip oysters, and giant clams. Barramundi is currently grown in ponds on the Adelaide River, and trials on Groote Eylandt and Goulburn Island are looking at growing clams in sea-based cages (NT Government, 2023).

The fisheries overlapping the OA and EMBA are shown in Figure 3-19, Figure 3-20 and Figure 3-21. Table 3-16 lists and describes the commercial fisheries and Santos' understanding of fishing effort based on publicly available information and consultation with Relevant Persons.

Consultation with the Australian Fisheries Management Authority (AFMA), NT Department of Industry, Tourism and Trade (NT Fisheries) and appropriate fisheries associations and licence holders is discussed in Section 4. A summary report including the outcomes of consultation with Relevant Persons, including any objections or claims and Santos' assessment of them, satisfying the requirements of section 24(b)(i)-(iii) of the OPGGS(E)R, is provided in Table 4-10. The full records of Relevant Persons consultation, as required by section 24(b)(iv) of the OPGGS(E)R, is provided in the Sensitive Information Report.

Table 3-16: Commonwealth and state fisheries that overlap the OA and/or EMBA

Commercial fishery	Licence Area		Description	Likelihood of interaction with fishers
	OA	EMBA		
Commonwealth-managed				
Northern Prawn Fishery	✓	✓	**Area**: extends from Joseph Bonaparte Gulf across the top end to the Gulf of Carpentaria. Most of the Northern Prawn Fishery effort lies in the Gulf of Carpentaria, Joseph Bonaparte Gulf and along the Arnhem Land coast (DoA, 2014). **Gear**: trawl. **Key target species**: The key target species are banana, tiger and endeavour prawns. There are 2 fishing seasons—the season end date depends on catch rates: • Season 1 (mainly banana prawns caught): 1 April to 15 June • Season 2 (mainly tiger prawns caught): 1 August to 30 November. Fishing for scampi also occurs in deeper waters, with fishing effort spread across 2–3 months of the year (December to February). **Effort** (2020): 52 active vessels; around 4,767 t (Patterson et al., 2021).	Interaction with this fishery in the OA is possible; however, medium and high fishing effort are outside the OA. The areas of concentrated effort are to the north and west of the Tiwi Islands and south of the OA.
Southern Bluefin Tuna Fishery	✓	✓	**Area**: The Southern Bluefin Tuna Fishery spans the Australian Fishing Zone. However, it is only active in the south and south eastern Australian water. **Gear**: purse seine and pelagic long line. **Key target species**: southern bluefin tuna. **Effort** (2020): 30 active vessels; around 5,429 t (Patterson et al., 2021).	No active commercial fishing effort reported in the OA or EMBA; therefore, interaction with this fishery is unlikely.
Western Skipjack Tuna Fishery	✓	✓	**Area**: The Western Skipjack Tuna Fishery spans the Australian EEZ and adjacent high seas, from Cape York to the Victoria–South Australia border, including waters around Tasmania and the high seas of the Pacific Ocean. **Gear**: purse seine **Key target species**: skipjack tuna **Effort** (2020): None. There has been no fishing effort since the 2008–2009 season, and in that season, activity was concentrated off South Australia (Patterson et al., 2021).	No active commercial fishing effort reported in the OA or EMBA; therefore, interaction with this fishery is unlikely.
Western Tuna and Billfish Fishery	✓	✓	**Area**: Operates in Australia's EEZ and the high seas of the Indian Ocean. In recent years, fishing effort has concentrated off south-west WA, with occasional activity off South Australia. **Gear**: pelagic longline. **Key target species**: bigeye tuna, yellowfin tuna, striped marlin, swordfish. **Effort** (2020): 3 active vessels; around 161 t (Patterson et al., 2021).	No active commercial fishing effort reported in the OA or EMBA; therefore, interaction with this fishery is unlikely.
NT-managed				
Aquarium Fishery	✓	✓	**Area**: Includes freshwater, estuarine and marine habitats to the outer boundary of the Australian Fishing Zone. Most marine species are collected within 100 km of Nhulunbuy and Darwin. A specimen shell collection enterprise occurs around Ashmore Reef and Cartier Island (outside the EMBA). **Gear**: handheld, nets and pots (dive-based). **Key target species**: fish, invertebrates and plants for aquariums. **Effort**: unknown – no restriction on the number of licences (NT Government, 2023).	No active commercial fishing effort reported in the OA. Some effort is possible in the EMBA for very limited periods of the year.
Spanish Mackerel Fishery	✓	✓	**Area**: Commercial fishing for Spanish mackerel is allowed from the high water mark to the outer boundary of the Australian Fishing Zone, which is 200 Nm offshore. Most fishing effort occurs near reefs, headlands and shoals and includes waters near Bathurst Island, New Year Island, northern and western Groote Eylandt, the Gove Peninsula, the Wessel Islands, the Sir Edward Pellew Group and suitable fishing grounds on the western and eastern mainland coasts. Fishing generally takes place around reefs, headlands and shoals. **Gear**: trolling, handline. **Key target species**: Spanish mackerel. **Effort**: 15 licences allowed (NT Government, 2023).	Interaction with this fishery in the OA is possible with fishers transiting within the area. Effort is expected within the EMBA at nearby shoals and banks, particularly in waters off Bathurst Island.
Offshore Net and Line Fishery	✓	✓	**Area**: Operates in NT waters from the low water mark to the boundary of the Australian Fishing Zone. Most fishing is done in the coastal zone within 12 Nm of the coast, and immediately offshore in the Gulf of Carpentaria. The fishery has an area of approximately 522,000 km^2 **Gear**: longlines or pelagic nets (there are restrictions on where certain gear can be used). **Key target species**: blacktip sharks, grey mackerel. **Effort**: Unknown – no restriction on the number of licences (NT Government, 2023).	Interaction with this fishery in the OA is possible but unlikely due to the concentration of fishing effort in near coastal areas and the distribution of the targeted species. One licence holder may fish off the south-west end of the Tiwi Islands for small pelagic fish.

Commercial fishery	Licence Area		Description	Likelihood of interaction with fishers
	OA	EMBA		
Demersal Fishery	✓	✓	**Area**: Demersal fishing is allowed from 15 Nm from the low water mark to the outer boundary of the Australian Fishing Zone, excluding the area of the Timor Reef Fishery. **Gear**: lines, fish traps and semi-demersal trawl nets. **Key target species**: snapper (various species). **Effort**: Unknown – 18 licences are currently issued (NT Government, 2023).	Interaction with this fishery in the OA is possible but highly unlikely due to the concentration of fishing effort that occurs along the eastern boundary of the Timor Reef fishery in water depths of 80-100 m, to the north-east of the OA.
Barramundi	✗	✓	**Area**: Barramundi fishing is allowed from the high water mark to 3 Nm seaward of the coast (with exclusion zones and restrictions). **Gear**: nets are set and retrieved from dinghies and fish are processed onboard motherships. **Key target species**: barramundi and king threadfin **Effort**: 14 licences are currently issued. Fishing effort spread across 8 months of the year (February to 30 September). (NT Government, 2023).	No fishery overlaps the OA. Effort is not expected within the EMBA.
Coastal Line	✗	✓	**Area**: Fishery is allowed from the high water mark to 15 Nm seaward of the coast. **Gear**: lines, hooks, cast nets, scoop nets or gaffs. **Key target species**: black jewfish and golden snapper **Effort**: 52 licences are currently issued. (NT Government, 2023).	No fishery overlaps the OA. Effort not expected within the EMBA.
Coastal Net Fishery	✗	✓	**Area**: Fishery is allowed from the high water mark to 3 Nm seaward of the coast. **Gear**: nets. **Key target species**: mullet **Effort**: 5 licences are currently issued. (NT Government, 2023).	No fishery overlaps the OA. Effort is expected within the EMBA.
Trepang Fishery	✗	✓	**Area**: Trepang fishing is allowed from the high water mark to 3 Nm seaward of the coast. Predominantly along the Arnhem Land coast, mainly around the Cobourg Peninsula and Groote Eylandt. **Gear**: harvested by hand either on foot or by diving, usually on neap tides during the dry season. **Key target species**: sea cucumber. **Effort**: 6 licences currently issued (NT Government, 2023).	No fishery overlaps the OA. Effort is expected within the EMBA.
Bait Net Fishery	✗	✓	**Area**: Bait fishing is allowed from the high water mark to 3 Nm seaward of the low water mark, excluding Darwin Harbour and Shoal Bay. **Gear**: bait net, cast net or scoop net. **Key target species**: all fish for use as bait except barramundi, threadfin salmon, Spanish mackerel or mud crab. **Effort**: 2 licences are currently issued (NT Government, 2023).	No fishery overlaps the OA. Effort is expected within the EMBA.
Mollusc Fishery	✗	✓	**Area**: Mollusc harvesting is allowed from the high water mark out to the low water mark. **Gear**: collected by hand. **Key target species**: all molluscs and shellfish, except pearl oysters. **Effort**: 1 licence is currently issued (NT Government, 2023).	No fishery overlaps the OA. Very low effort is expected within the EMBA.
Mud Crab Fishery	✓	✓	**Area**: Mud crab harvesting is confined to coastal mudflats and estuaries, excluding Darwin Harbour, Kakadu National Park, Leaders Creek and most creeks adjoining Shoal Bay. **Gear**: pots. **Key target species**: mud crabs. **Effort**: 49 licences are currently issued (NT Government, 2023).	No fishery overlaps the OA. Fishing effort is concentrated in the Gulf of Carpentaria (outside of the EMBA); however, very low effort may occur within the EMBA.
Pearl Oyster Fishery	✓	✓	**Area**: high water mark to the outer boundary of the Australian fishing zone, 200 Nm offshore. **Gear**: harvested by hand. **Key target species**: pearl oysters. **Effort**: 5 licences are currently issued with each licence able to harvest 138,000 oysters each year (NT Government, 2023).	While there is a licence area that intersects with the OA, there have been no active commercial fishing effort reported in the OA; however, high effort is expected within the EMBA.
WA-managed				
Abalone	✗	✓	**Area**: Operates between the NT and South Australian borders. **Gear**: unknown. **Key target species**: abalone. **Effort** (2020): 0 diver days; total catch 0 t. Closed since 2012 due to environmentally induced mortality (Newman et al., 2021).	N/A
Kimberley Crab Fishery	✗	✓	**Area**: Operates off the north-west coast of WA. **Gear**: crab traps.	No fishery overlaps with the OA and the EMBA intersects the outer limits of the fishing licence boundary. Interaction with this fishery is highly unlikely.

Commercial fishery	Licence Area		Description	Likelihood of interaction with fishers
	OA	EMBA		
			Key target species: green and brown mud crab. **Effort** (2020): effort occurring between April and September with a catch of 1.5 t (Newman et al., 2021).	
Mackerel Managed Fishery	✗	✓	**Area**: Commercially fished between Geraldton and the WA/NT border. **Gear**: trolling. **Key target species**: Spanish mackerel. **Effort**: active vessels: (unknown); around 300 t (Gaughan and Santoro, 2021).	No fishery overlaps the OA. Effort is expected within the EMBA.
Marine Aquarium Fishery	✗	✓	**Area**: Operates between the NT and South Australian borders. Typically more active in waters south of Broome with higher levels of effort around the Capes region of south-west WA, Perth, Geraldton, Exmouth, Dampier and Broome. **Gear**: unknown. **Key target species**: coral, live rock, algae, seagrass and invertebrates. **Effort** (2020): 32.12 t (Newman et al., 2021).	No fishery overlaps with the OA and the EMBA intersects the outer limits of the fishing licence boundary, which extends the entire WA coastline. Interaction with this fishery is highly unlikely.
Northern Demersal Scalefish Fishery	✗	✓	**Area**: Operates off WA's coast in waters east of 120°E longitude. **Gear**: handline, dropline and fish traps, although the fishery has essentially operated as a trap-based fishery since 2002. **Key target species**: goldband snapper and red emperor. **Effort**: active vessels: (unknown); around 1,500 t (Gaughan and Santoro, 2021).	No fishery overlaps the OA. Effort is expected within the EMBA.
South West Coast Salmon Fishery	✗	✓	**Area**: Perth metropolitan area extending to Cape Beaufort (WA/NT border). No fishing takes place north of the Perth metropolitan area. **Gear**: beach seine nets. **Key target species**: Western Australian salmon. **Effort**: Insufficient information.	No fishery overlaps the OA. No fishing takes place north of the Perth metropolitan area, despite the managed fishery boundary extending to Cape Beaufort (WA/NT border).
Specimen Shell Fishery	✗	✓	**Area**: Operates between the NT and South Australian borders. **Gear**: unknown. **Key target species**: cowries, cones, murexes and volutes. **Effort**: 4,258 shells collected. 30 licenses (15 fished in 2020) (Newman et al., 2021).	No fishery overlaps the OA. The EMBA intersects the outer limits of the fishing licence boundary, which extends the entire WA coastline. Interaction with this fishery is highly unlikely.
West Coast Deep Sea Crustacean Fishery	✗	✓	**Area**: Operates primarily in the Gascoyne bioregion in WA. **Gear**: unknown. **Key target species**: champagne, giant and crystal crab. **Effort** (2020): 153 t (Newman et al., 2021).	No fishery overlaps with the OA. The EMBA intersects the outer limits of the fishing licence boundary. The concentration of fishing occurs in the Gascoyne bioregion. Interaction with this fishery is highly unlikely.

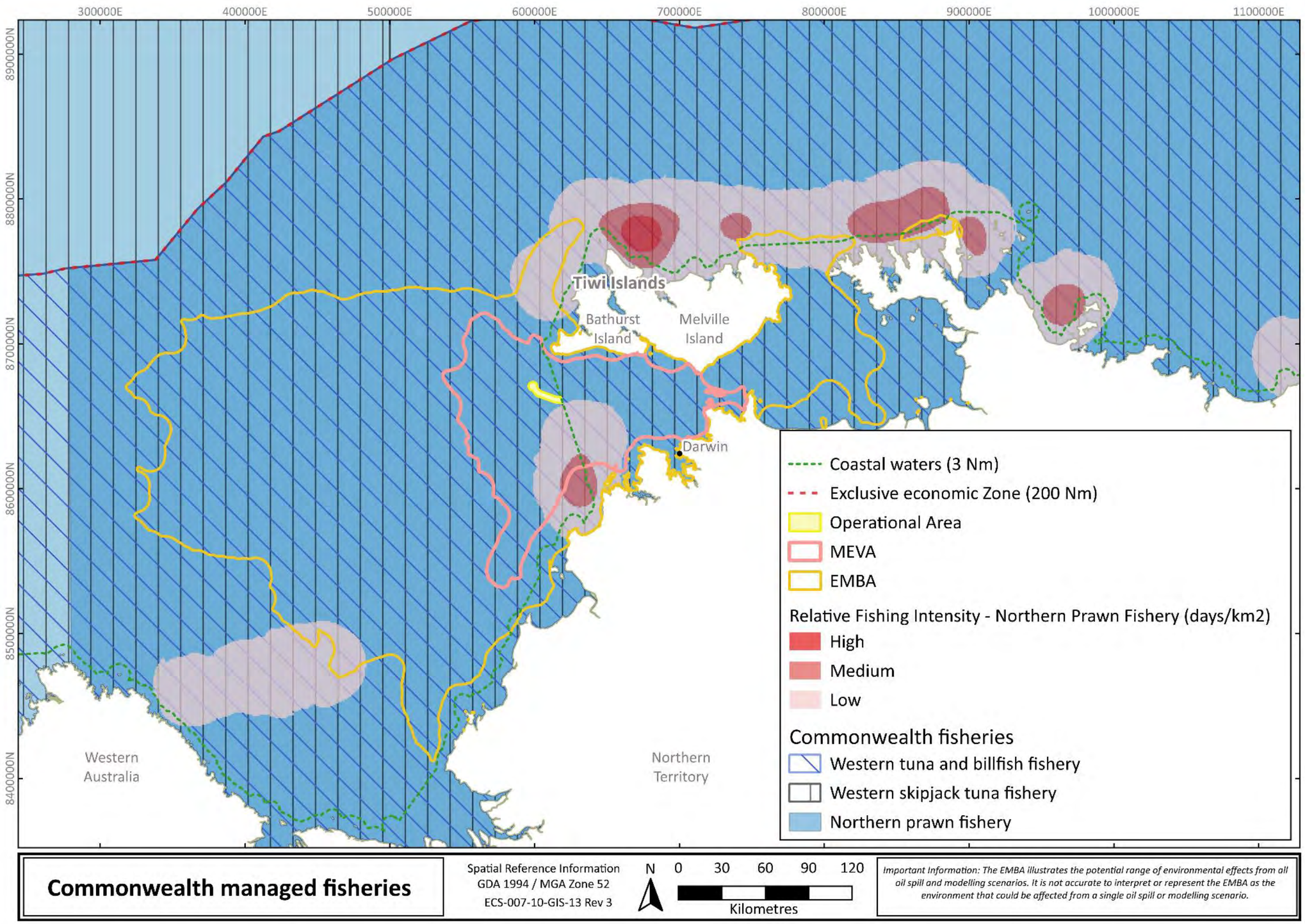


Figure 3-19: Commonwealth-managed fisheries overlapping the OA and/or EMBA

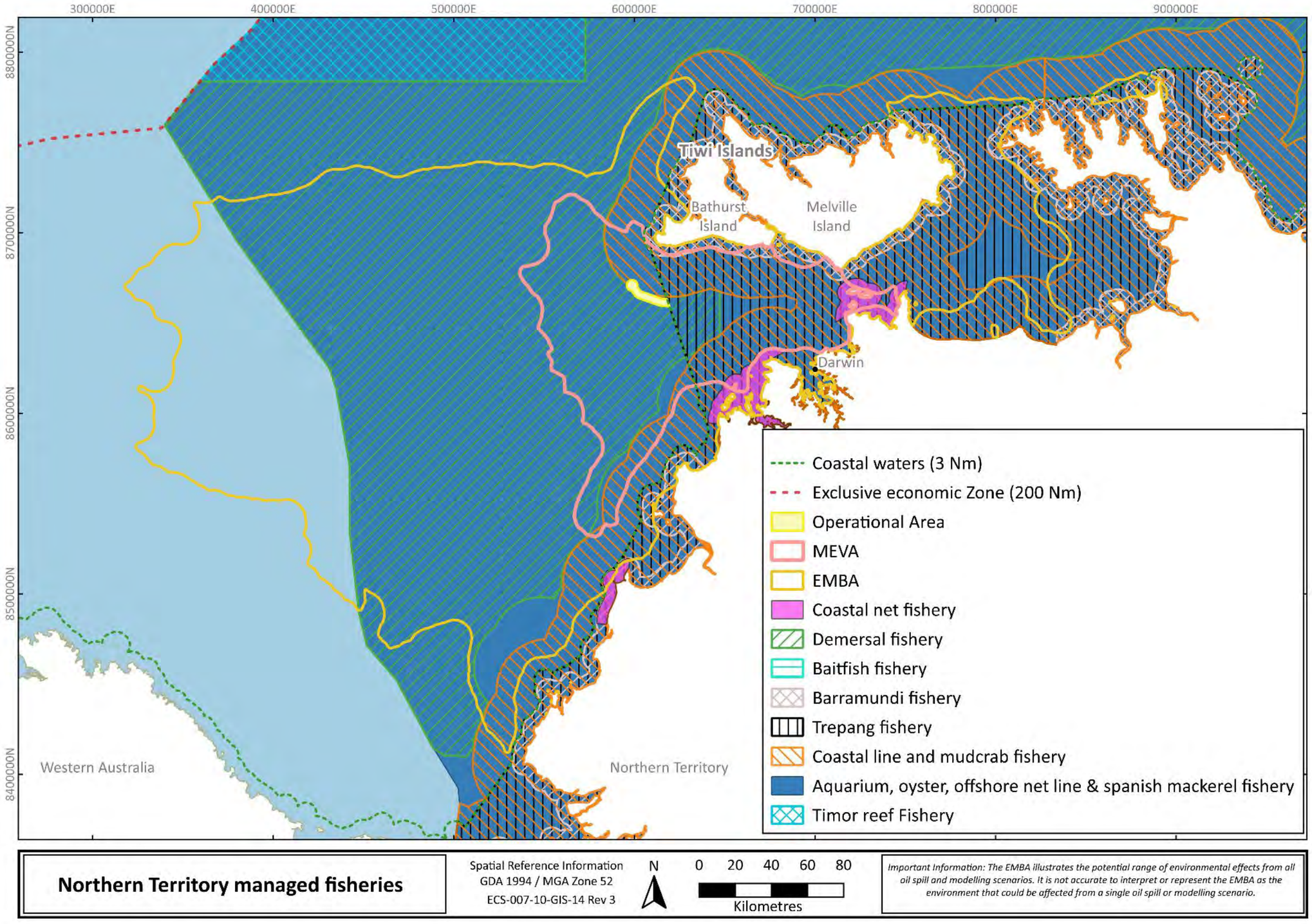


Figure 3-20: Northern Territory managed fisheries overlapping the OA and/or EMBA

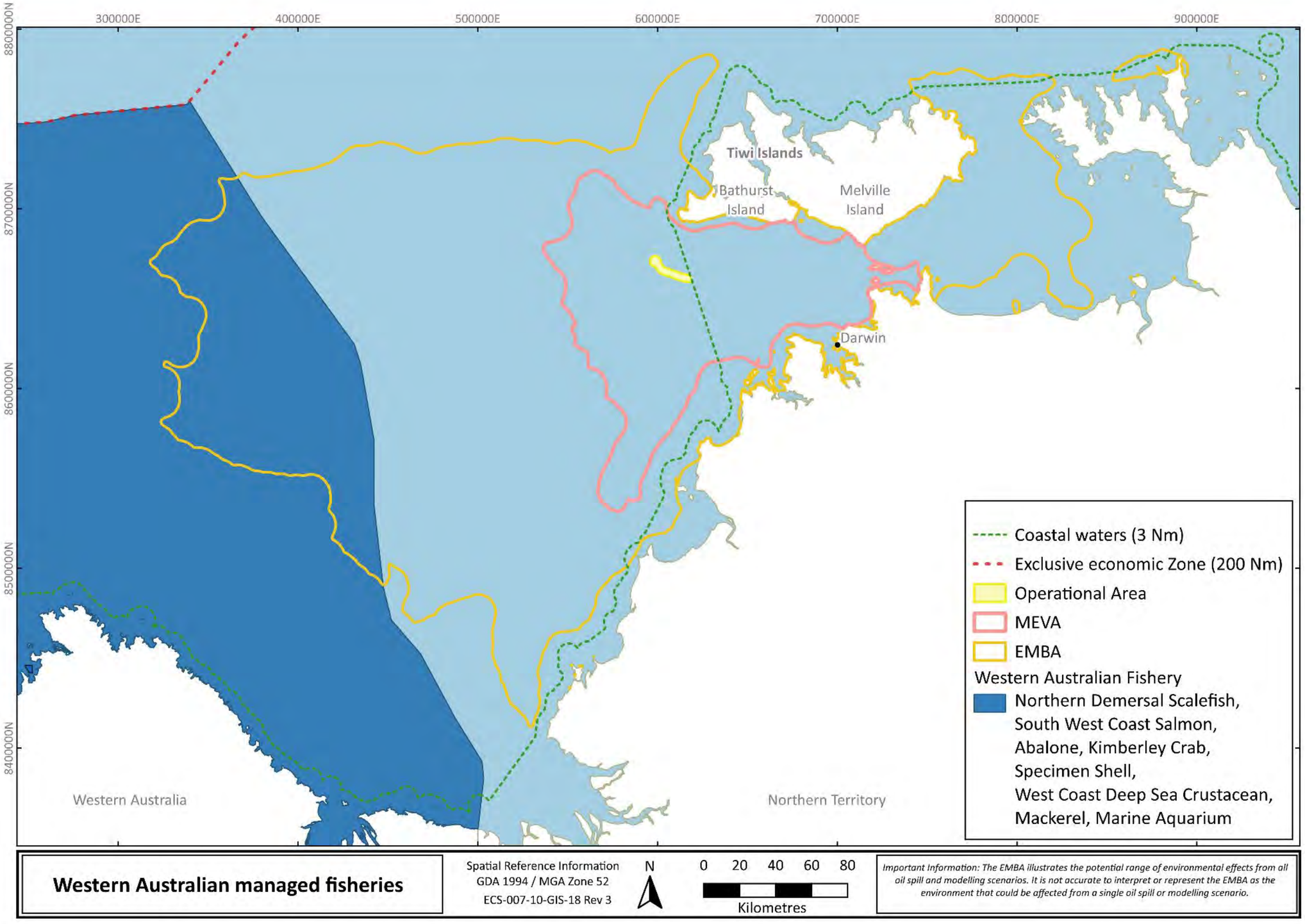


Figure 3-21: Western Australian managed fisheries overlapping the EMBA

3.2.13.2 Energy industry

No established energy operations are located within or in the immediate surrounds of the OA. However, there are 2 existing pipelines within the vicinity—Bayu-Undan (0.1 km or greater distance from the OA) and Ichthys (46.5 km distance from the OA). The closest operational offshore production facilities and in-field subsea infrastructure are the Eni operated Blacktip Gas, approximately 254 km south-west from the OA and the Santos-operated Bayu–Undan platform, approximately 375 km north-west from the OA.

Petroleum retention lease area and exploration permit leases within the EMBA are held by various energy operators (and subsidiaries) including INPEX Browse, MEO International, Neptune Energy Bonaparte, Eni, EOG Resources and MBS Oil.

3.2.13.3 Defence activities

The OA intersects a practice area, and the EMBA intersects the practice and training areas of the North Australian exercise area and Darwin air weapons range (Figure 3-22). These areas are maritime military zones administered by the Department of Defence and used for offshore naval exercises and onshore weapons-firing training.

The Australian Border Force also undertakes civil and maritime surveillance (and enforcement) in Australian offshore maritime waters, which includes the Australian EEZ. During their surveillance, Australian Border Force vessels may transit through the OA and EMBA.

Consultation with the Department of Defence and Australian Border Force is discussed in Section 4. A summary report including the outcomes of consultation with Relevant Persons, including any objections or claims and Santos' assessment of them, satisfying the requirements of section 24(b)(i)-(iii) of the OPGGS(E)R, is provided in Table 4-10.

3.2.13.4 Telecommunications cables

The North-West Cable System (NWCS) is located approximately 2.5 km south of the OA. Extending 2,100 km from Darwin to Port Hedland, the NWCS connects Australia's remote northern and western regions, including offshore energy industry facilities, with onshore locations. Although the NWCS intersects the EMBA, a hydrocarbon spill will not have any impact on submarine cables.

3.2.13.5 Shipping

AMSA has established a network of shipping fairways off the north-west coast of Australia to manage traffic patterns. The shipping fairways are designed to keep shipping traffic away from offshore infrastructure to reduce the risk of a vessel collision (AMSA, 2013).

The use of the fairways is strongly recommended and the International Regulations for Preventing Collisions at Sea 1972 apply to all vessels navigating within or outside the shipping fairways. Under the *Navigation Act 2012* (Cth), certain vessels operating in Australian waters are required to report their location daily to AMSA's Joint Rescue Coordination Centre (JRCC). This Australian Ship Reporting System is an integral part of the Australian Maritime Search and Rescue system.

The OA does not overlap any ports. Darwin Port is a major shipping port in Australia located approximately 90 km south-south east of the OA. In 2022–2023, there were 1,569 vessel calls to port (Landbridge Darwin Port, 2024). Darwin Port is a major port for vessels servicing operations offshore from north-west Australia. The primary shipping channels within the EMBA are between Darwin and Southeast Asian ports. Figure 3-23 illustrates the vessel movement density within the EMBA. Average vessel displacements and speeds for shipping vessels transiting the EMBA and OA include:

- bulk carriers averaging 55,300 t with speeds of 14 knots
- livestock carriers averaging 2,800 t with speeds of 12 knots
- general cargo vessels averaging 4,900 t with speeds of approximately 12 knots.

Although Darwin Port is the primary active port in the region, there is a port, Port Melville, located at the Tiwi Islands (outside of the EMBA), which is approximately 83 km north-east of the OA and 125 km north of Darwin.

3.2.13.6 Recreation and tourism

In NT there were 781,000 visitors for the purposes of tourism during the year ending September 2022 with a $1,332 million spend (NT Tourism, 2022). While tourism activities (e.g. recreational fishing and boating, charter boat operations) may occur within the OA, they are likely to be transitioning the area to access islands, shoals and shipwrecks outside the OA.

In the NT, 95% of recreational fishing occurs in in areas <5 km from the coastline (West et al., 2022). The peak fishing effort is between October to December and April to June (West et al., 2022). The mainland coastline, several shoals and banks within the EMBA may be visited by small numbers of recreational fishers/charter vessels targeting fish inhabiting these shallower offshore features. The mainland coastline also offers recreation, and cultural and environmental tourism activities.

Scuba diving, snorkelling and other charter vessels are also a significant tourist attraction, with operators visiting the numerous shipwrecks, coral reefs and artificial reefs and embarking on day or multiday trips out to offshore islands and shoals (INPEX Browse, 2010). The peak tourism period occurs between May to October.

The Tiwi Islands are a popular tourist destination offering cruises, fishing, sailing and water tours among other cultural activities. Kakadu National Park is also an important visitor attraction which has coastal values that intersect the EMBA. Tourism and recreational activities are likely to be more concentrated within coastal waters of the EMBA, but activities such as deep-water fishing, diving and snorkelling around offshore shoals and reefs may potentially take place in offshore areas of the EMBA.

3.2.13.7 Underwater cultural heritage

Historic shipwrecks and sunken aircraft, including associated artefacts that have been in Australian waters more than 75 years, are subject to automatic protection under the UCH Act. Shipwrecks, sunken aircraft and other types of UCH that have been underwater for less than 75 years can be protected through an individual declaration by DCCEEW based on an assessment of heritage significance (DCCEEW, 2023). Underwater cultural heritage artefacts continue to be protected after removal from the water. There are no declared protected UCH sites within the OA. Multiple known shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur within the EMBA (see Figure 3-24).

Table 3-17 describes the known and located UCH sites protected under the UCH Act and *Heritage Act 2011* (NT) within the EMBA and lists the distances to the OA, noting that there are no sites within the OA.

Santos engaged Cosmos Archaeology to undertake a maritime archaeological heritage assessment (MAHA) (Cosmos Archaeology, 2022; Appendix G). The study area of the MAHA is defined as a minimum 1,000 m buffer on either side of the DPD Project route (e.g. both Commonwealth and NT waters). An archaeological scope of works prepared by the Department of Territory Families, Housing and Communities, NT Heritage branch (DTFHC-NT-Heritage), in November 2021, informed the Cosmos Archaeology assessment. Cosmos Archaeology analysed data collected during the geophysical survey conducted by Fugro in 2021. Cosmos Archaeology confirmed no cultural or magnetic anomalies were detected within the OA (Cosmos Archaeology, 2022). Cosmos Archaeology noted that 29 known but unlocated shipwrecks and 25 known but unlocated aircraft wrecks are believed to have sunk within the MAHA study area vicinity based on recorded historical accounts (Cosmos Archaeology, 2022). Therefore, these unlocated shipwrecks and aircraft wrecks could potentially be located within the EMBA but outside the OA. Cosmos Archaeology identified 17 known shipwrecks, 5 unexploded ordnance (UXO) and 6 instances of maritime infrastructure (including anti-submarine defences and telegraph cables) within the MAHA study area (outside of the OA) (Cosmos Archaeology, 2022).

Table 3-17: Located UCH protected under UCH Act and *Heritage Act 2011* (NT) and distance to OA

Name	Protected under the UCH Act	Underwater heritage protected zones	Protected under the *Heritage Act 2011* (NT)	Description	Site distance to OA (~km)
B-25D Mitchell N5-140	✓	×	×	Aircraft crashed off the coast of Nightcliff, NT in April 1943, cause unknown.	85
Booya	×	✓ 150 m under Heritage Act 2011 (NT)	✓	Sailing vessel wrecked during Cyclone Tracy in 1974.	78
Brisbane	✓	×	×	Vessel struck Fish Reef near the entrance to Bynoe Harbour, NT in October 1881 where it became permanently stranded.	50
British Motorist	✓	×	✓	Vessel sunk during attacks by Japanese aircraft in February 1942, while in use by the British Merchant Navy for fuel transportation purposes.	89
Catalina PBY-4 PatWing10 #4 or #8 ("Catalina 6")	✓	×	✓	One of 3 Catalina aircrafts sunk at mooring in February 1942 by Japanese air raid. Part of USN Patrol Wing 10.	95

Name	Protected under the UCH Act	Underwater heritage protected zones	Protected under the *Heritage Act 2011* (NT)	Description	Site distance to OA (~km)
Dakota A65-115 (VH-RGC)	✓	×	×	Aircraft crashed off the coast of Mindil Beach, NT in September 1945.	83
Ellengowan	✓	×	✓	Vessel sank at its moorings at the Channel Island quarantine station anchorage in 1888.	96
HMAS *Kelat*	✓	×	✓	Ship was sunk during attacks by Japanese aircraft in February 1942.	95
HMAS *Neptuna*	✓	×	✓	Ship was sunk during attacks by Japanese aircraft during February 1942, while in use by the Allies to transport people, troops and supplies.	90
HMAT *Zealandia*	✓	×	✓	Ship was sunk during attacks by Japanese aircraft in February 1942, while in use by the Allies to transport people, troops and supplies.	91
I-124 (Submarine)	✓	✓ 800 m under the UCH Act	×	The submarine was sunk by multiple attacks by Allied Forces including Australian and US in January 1942. I-124 was an Imperial Japanese Navy minelaying submarine and the sinking resulted in the loss of all 74 crew.	1.25
RAAF Catalina A24-1 (“Catalina 1”)	✓	×	✓	Aircraft crashed during takeoff in August 1945.	100
RAAF Catalina A24-206 (“Catalina 3”)	✓	×	×	Aircraft sunk from accidental depth charge explosion June 1945.	97
RAAF Catalina A24-69 (“Catalina 2”)	✓	×	×	Aircraft caught fire by accident in December 1945 while moored in Darwin Harbour, NT.	96
Spitfire A58-372 (ex-JG106)	✓	×	✓	Aircraft crashed into Clarence Strait, NT in July 1945.	126
SS *Florence D*	✓	✓ 800 m under the UCH Act	×	Ship was sunk during attacks by Japanese aircrafts in February 1942, while chartered by the US Navy to serve as a blockade runner to transport supplies.	9
SS *Macumba*	✓	✓ 800 m under the UCH Act	×	Merchant ship was sunk during an attack by 2 Japanese aircraft in August 1943, while carrying supplies and war materials from Brisbane to Darwin.	478
Subsea telegraph cable – duplicate	×	×	✓	Duplicate subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java, Indonesia. The duplicate cable was of the same composition as the original 1871 cable.	31
Subsea telegraph cable –replacement	×	×	✓	Replacement subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java, Indonesia. Cable is of similar composition to the earlier 2 but contained an additional layer of brass tape around the core to protect the cable from marine borer (namely *Teredo navalis*) attack.	54
Subsea telegraph cables landing	×	×	✓	First installation of an approximately 1,561 km long subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java,	90

Name	Protected under the UCH Act	Underwater heritage protected zones	Protected under the *Heritage Act 2011* (NT)	Description	Site distance to OA (~km)
				Indonesia. The cable consists of seven stranded copper wires, insulated with gutta-percha latex, sheathed in galvanised iron wire armour, and an outside covering of tarred hemp.	
USAT *Don Isidro*	✓	×	×	Vessel was sunk during Japanese aircraft during February 1942, while in use by the British Merchant Navy for fuel transportation purposes.	35
USAT *Mauna Loa*	✓	✓ 100 m under *Heritage Act 2011* (NT)	✓	Ship was sunk during attacks by Japanese aircraft in February 1942, while chartered by the US Navy to transport supplies.	89
USAT *Meigs*	✓	✓ 100 m under *Heritage Act 2011* (NT)	✓	Ship was sunk during attacks by Japanese aircraft in February 1942, while chartered by the US Navy to transport supplies.	88
USN Catalina PatWing 10 #41 ("Catalina 4")	✓	×	✓	One of 3 Catalinas sunk at mooring in February 1942 by Japanese air raid. Part of USN Patrol Wing 10.	97
USN Catalina PatWing10 #4 or #8 ("Catalina 5")	✓	×	✓	One of 3 Catalinas sunk at mooring in February 1942 by Japanese air raid. Part of USN Patrol Wing 10.	97
USS *Peary*	✓	✓ 100 m under *Heritage Act 2011* (NT)	✓	Ship was sunk during attacks by Japanese aircraft in February 1942.	89

During the Last Glacial Maximum, sea level was at its minimum at 125 m below the present-day sea level (Wessex, 2023). A significant portion of the EMBA is within the 125 m depth contour, which represents the furthest extent of historical human habitation and potential for First Nations UCH. Water depths within the OA are between approximately 50 m to 60 m; therefore, there is potential for unknown First Nations UCH to exist in the OA. Given the extent of time since sea levels were at these low levels (~20,000 years ago), terrestrial landforms, and any associated heritage artefacts, within the EMBA are likely to have been significantly influenced, over thousands of years, by environmental processes of erosion, sedimentation and deposition as sea levels increased to their present levels (Posamentier, 2023). A First Nations archaeological assessment for the DPD Project Area was based on a detailed geomorphological assessment. This study focussed on the likelihood for deposits associated with the Last Glacial Maximum (LGM) to be impacted by the DPD Project. Only one location where potential sediments associated with the LGM were indicated was in the vicinity of KP36.4 to 37.9 (outside of the OA). At this location, potential sediments are assessed likely to be at a depth of approximately 18 m below the sea floor. At this depth, no activities related to the construction of the DPD project will have any direct or indirect impact on these potential sediments. In any event, the location of the potential sediments associated with the LGM is outside the OA (OzArk, 2024).

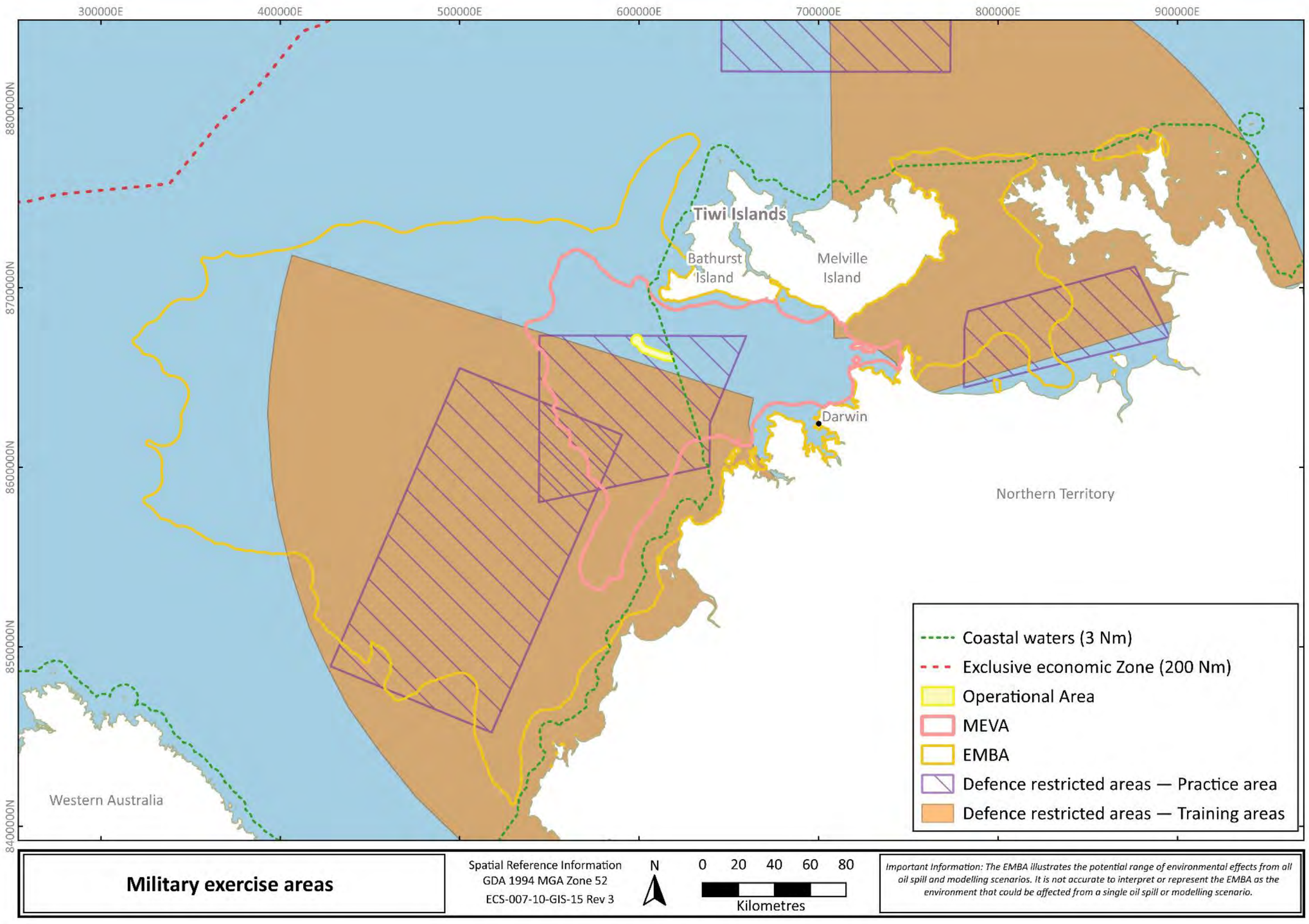


Figure 3-22: Defence training and exercise areas within the EMBA

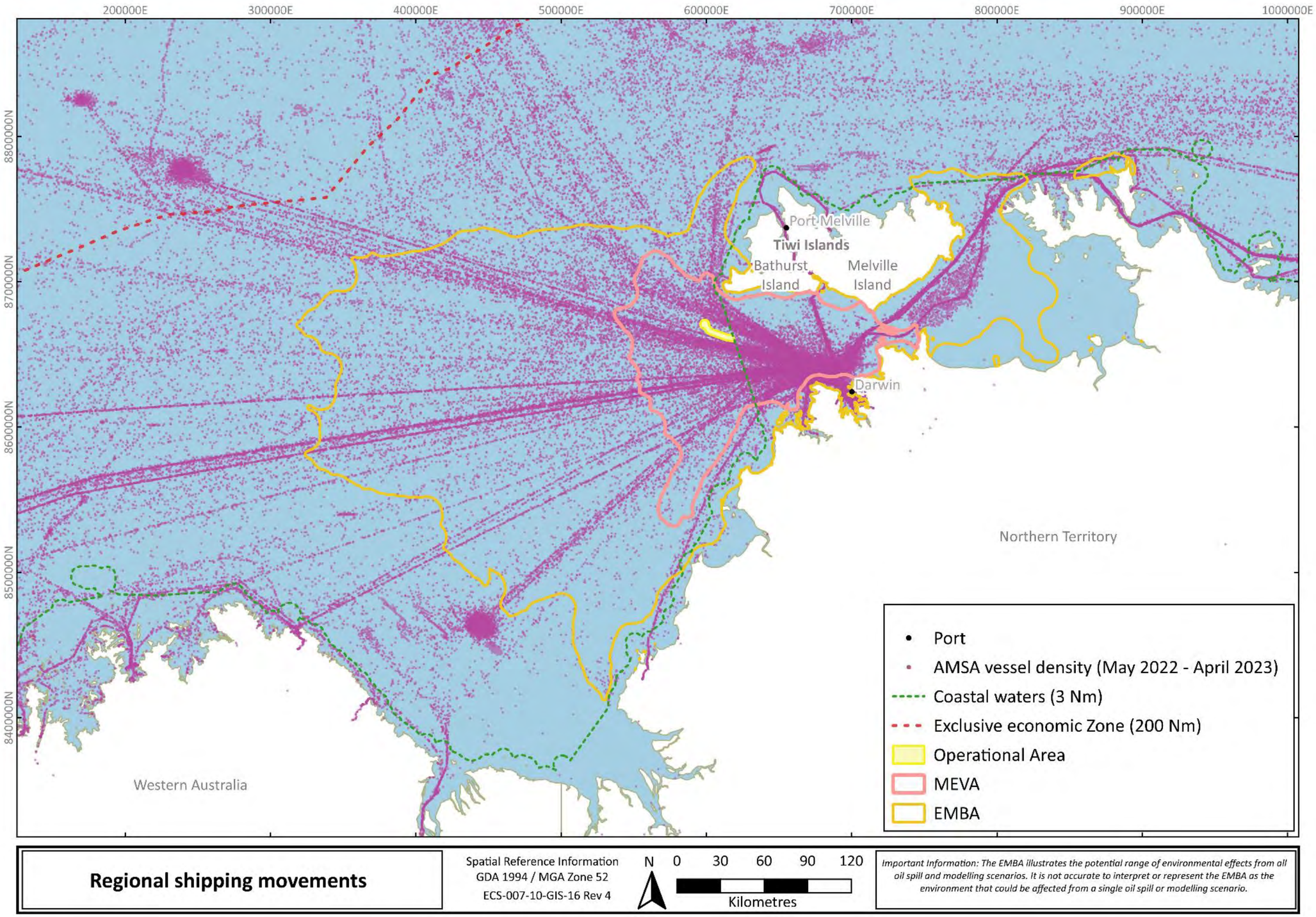


Figure 3-23: Regional shipping movements overlapping or proximal to the EMBA

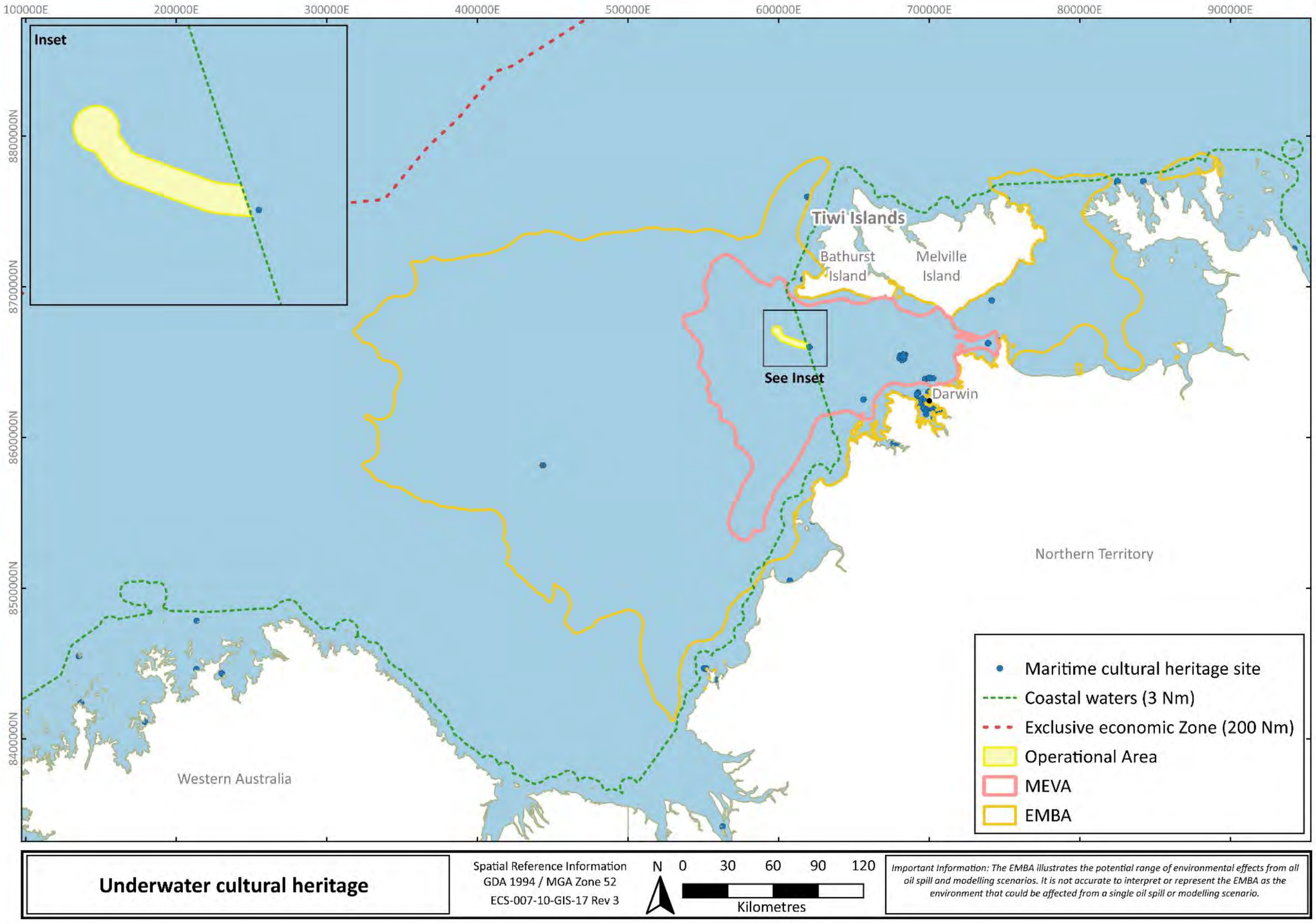


Figure 3-24: Underwater cultural heritage overlapping or proximal to the EMBA

3.2.14 Cultural features

3.2.14.1 Meaning of 'cultural features'

In its evaluation, Santouaus has had close regard to the Court's guidance and findings in *Munkara v Santos NA Barossa Pty Ltd (No 3)* [2024] FCA 9 (*Munkara*) in identifying the cultural features of the environment. In *Munkara*, the Court clarified the meaning of 'cultural features' in the definition of 'environment' in section 4 (now section 5) of the OPGGS(E)R:

- The phrase cultural features has a 'communal aspect' to it. This necessitates that individual beliefs are broadly representative of the beliefs of other members of the group, although there does not need to be consensus[11]. An idiosyncratic view or belief of an individual may be a manifestation of the culture of that person's society, but if it is not broadly representative of the beliefs of a group, then it will not constitute a cultural feature[12].

In the context of limb (a) of the definition of 'environment', 'cultural features' attaches to the word 'ecosystem' with all of its constituent parts, including people and communities. The focus must remain on the ecosystem, of which people form a part. This focus is not upon an individual person devoid of the context of the ecosystem[13].

- In the context of limb (c) of the definition of 'environment', each of the circumstances that:
  - an area is the subject of a spiritual connection to Aboriginal people, provided that the connection is by the laws and customs of *a people*[14];
  - an 'area' is the country of an Aboriginal person in accordance with Aboriginal traditional laws and customs[15]; and
  - there exists in those areas, locations or places cultural heritage in the form of artefacts or other objects evidencing human occupation and activities over the course of human history[16],

  may readily be described as a 'cultural feature' of that location, place or area.
- In order for there to be a 'cultural feature' of the environment, there must be a 'sufficiently cogent or coherent belief' that is 'sufficiently accepted' so that it can be described as having normative content for the people or community viewed as a constituent part of an ecosystem, such that a singular perspective will not suffice[17]. The beliefs and values must be held by the Relevant People as a people[18]. Further, the question of whether a view is sufficiently cogent or coherent may be answered by reference to the customs and practices of the Relevant People, including relevant customs and practices concerning the authority to speak on a topic or relevant customs and practices (if any) concerning the resolution of division[19].
- The inquiry as to what is 'broadly representative' must be undertaken in the proper cultural context, including by assessing which persons are generally accepted as having authority to speak on the particular topic and excluding those persons who are culturally irrelevant[20].
- Evidence of dissenting views cannot be ignored, because they tend against a finding that beliefs have broad acceptance[21].
- Proof that beliefs are broadly representative will be more difficult in the face of discord within the relevant group, and even more so when the discord is among persons of equivalent authority and persons having the same lineage[22].

3.2.14.2 Introduction

First Nations people have occupied the Australian continent for a period in the order of 65,000 years, making them the oldest continuous culture in the world. First Nations Australians' *connection to land is essential to the continued*

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[11] *Munkara at [922], and see also at [194]-[199].*
[12] *Munkara at [204].*
[13] *Munkara at [204].*
[14] *Munkara at [201].*
[15] *Munkara at [855].*
[16] *Munkara at [200].*
[17] *Munkara at [206].*
[18] *Munkara at [208].*
[19] *Munkara at [206].*
[20] *Munkara at [923].*
[21] *Munkara at [923].*
[22] *Munkara at [924].*

cultural survival of Australia's First Peoples as well as their economic and social development (AIATSIS, 'Land Rights', Reuters).

Santos acknowledges the tradition of the First Nations people of Australia includes a cultural and spiritual connection to their land and waters, including sea country. These connections are rooted in their traditional communal beliefs and practices. First Nations people view their land and waters as integral to their identity, culture, and spirituality and they have a deep respect for the natural world. First Nations persons and groups that identify as saltwater people/groups have a complex relationship with sea country, based, for the most part, on inherited rights, including totemic affiliation, and ceremonial duties. Santos understands that First Nations groups of Northern Australia are generally aware of the nature and geographic extent of their areas of responsibilities over sea country.

The cultural heritage of First Nations people is defined by Indigenous tradition through traditional laws and customs amongst themselves.

It includes a vast array of cultural artifacts, practices and beliefs. The protected heritage of First Nations peoples is also of cultural value to Australia and the global community. The cultural value of First Nations protected heritage to Australia is evidenced and given force by a range of factors, including the laws, regulations and institutions established across Australia that are designed specifically to protect First Nations rights and interests in relation to sacred sites and other aspects of First Nations cultural heritage, including the *Native Title Act 1993* (Cth) (NT Act), A*boriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) (ATSIHP Act), UCH Act, *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALR Act) and *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) (NTASS Act) (see Section 3.2.14.3 to 3.2.14.7).

In identifying the cultural features of the OA and EMBA, Santos has considered:

1. information shared during consultation for this EP;
2. information shared during consultation/engagement relevant to other Barossa EPs;
3. lay and expert evidence adduced in *Munkara*, as well as the court's reasoning and findings;
4. expert advice provided by consultant anthropologists (some of which was considered by the Court in *Munkara*); and
5. other publicly available information.

Information about potential cultural features obtained during consultation/engagement for D&C EP, SURF EP and GEP EPs has been considered and included in this EP where potentially relevant, having regard to the recent guidance in *Munkara*.

Further to point 4 above, Santos commissioned an independent expert assessment by Dr Brendan Corrigan for the purpose of identifying UCH places along the route of the Barossa Gas Export Pipeline (GEP) west and north-west of the Tiwi Islands ("Corrigan 2023 Report"). As part of his work, Dr Corrigan reviewed extensive ethnographic studies of the Tiwi people in order to gain an historical understanding of their society, culture and hierarchy, and conducted extensive interviews amongst the communities.

In addition, Dr Corrigan has also prepared an anthropological survey report ("Corrigan 2024 Report") on cultural and spiritual values in relation to the DPD Project which includes this OA. Dr Corrigan concluded that a precise boundary which captures the extent of interests of both the Tiwi Islanders and Larrakia Peoples' in the context of the DPD and GEP is unclear. However, cultural and spiritual values of these groups are understood as extending out into the seas for an indeterminate distance. For example, the spiritual beings Jirukupai (crocodile man) and Ampitji are thought by Tiwi Islanders to travel in the surrounding sea, but it unclear precisely how far. This is also consistent with a range of views put to the Federal Court more recently, in the context of the GEP EP (see for example, Corrigan 2023). Similarly, Tiwi Islanders routinely travel large distances at sea for the purpose of fishing and hunting turtle and dugong. However, there is no settled evidentiary data on the actual extent of these cultural and economic activities in the context of a sea country claim or the like.

There are no native title claims or determinations registered or sites recorded under the ATSIHP Act, UCH Act or ALR Act, Aboriginal land rights claimed or granted under the ALR Act or Indigenous Protected Areas (IPAs) within the OA.

3.2.14.3 Native title

Native title was first recognised in Australia in *Mabo v Queensland (No 2)* (1992) 175 CLR 1 (*Mabo*). Consequent to that decision, the NT Act was enacted to provide a statutory mechanism for the recognition of claims for, and protection of, native title.

Native title claims are applications made to the Federal Court under the NT Act for a determination, or decision about native title in a particular area. A claimant application is made by a native title claim group which asserts it holds native title rights and interests in an area of land and/or water, according to its traditional laws and customs.

By making a claimant application, the native title claim group seeks a decision that native title exists, so its physical and spiritual rights and interests are recognised by the common law of Australia. This is called a native title determination. A determination is a decision by a recognised body, such as the Federal Court or High Court of Australia, that native title either does or does not exist in relation to a particular area.

A native title claim group must demonstrate that the acknowledgement and observance of traditional laws and customs have continued substantially uninterrupted since sovereignty (capable of being recognised by the common law of Australia) (section 223(1) NT Act). Native title rights and interests are determined as a question of fact. For example, in *Western Australia v Ward* (2000) 99 FCR 316, [243], the Full Federal Court stated that:

Acknowledgment and observance may be established by evidence that traditional practices and ceremonies are maintained by the community, insofar as that is possible, off the land, and that ritual knowledge including knowledge of the Dreamings which underlie the traditional laws and customs, continue to be maintained and passed down from generation to generation. Evidence of present members of the community, which demonstrates knowledge of the boundaries to their traditional lands, in itself provides evidence of continuing connection through adherence to their traditional laws and customs.

A requirement for obtaining a positive determination of native title in court is proving that there is an organised group that occupied the claimed land and waters at the time of British annexation. The requirement of an 'organised society' is set out in *Mabo*.

From this, it is considered that it is a group of native titleholders that hold communal native title and that native title claims are understood to apply to the area over which First Nations groups are claiming their rights and interests.

A native title determination is where native title has been determined to exist, which may include only part of a native title claim, and represents the lands and waters over which the native title group has been recognised to have rights and interests. Where a Court has determined that native title exists, those native title rights and interests will be held (often but not always) in trust by a Registered Native Title Body Corporate designated by the Native Title holders (section 57 NT Act).

Native title is, in any particular case, a collection of rights and interests the content of which varies according to the traditional laws and customs from which they are, in each particular case, derived. For example, these rights may include the right to have access, to camp, hunt, fish, use water, hold meetings, perform ceremony and/or protect cultural sites (see for example, *Akiba v The Commonwealth* (2013) 250 CLR 209).

For the Activity, there are no native title claims or determinations that overlap with the OA; however the EMBA intersects the Croker Island and Larrakia native title determinations (refer to Figure 3-25). The areas of responsibility for regional native title representative bodies that overlap the EMBA are shown in Figure 3-26.

Santos was provided with information by First Nations people during consultation meetings for the D&C EP and by NOPSEMA in the course of preparing the D&C EP. NOPSEMA provided Santos with 4 separate letters from Tiwi clan members to NOPSEMA in April 2022 requesting the statement of reasons for NOPSEMA's decision to accept Revision 3 of the D&C EP (2022 Statement of Reasons Requests[23]), and asked Santos to consider the relevance of the information to the EMBA under the D&C EP. This information has been considered within Sections 3.2.14.9 to 3.2.14.11 for this EP.

3.2.14.4 Indigenous land use agreements

An Indigenous land use agreement (ILUA) is a voluntary agreement between native title parties and other people or bodies about the use and management of areas of land and/or waters. An ILUA can be made over areas where:

- native title has been determined to exist in at least part of the area
- a native title claim has been made
- no native title claim has been made.

While registered, ILUAs bind all native title holders to the terms of the agreement. ILUAs also operate as a contract between the parties. A register of ILUAs is maintained by the Native Title Registrar. The register of ILUAs does not disclose the existence of any ILUA which overlaps with the OA; however, the EMBA does overlap the areas of land and tidal waters (between the low water mark and the high water mark) of the Kenbi and a small coastal portion of the Mary River ILUAs (refer to Figure 3-25).

The NLC is a party to the Kenbi ILUA and NLC and members of the Wulna Clan are parties to the Mary River ILUA.

[23] *2022 Statement of Reasons Requests asked for copies of statement of reasons to be sent to EDO email addresses.*

3.2.14.5 Indigenous protected areas

IPAs are areas of land and sea managed by First Nations groups as protected areas for biodiversity conservation through voluntary agreements with the Australian Government. IPAs are an essential component of Australia's National Reserve System, which is the network of formally recognised terrestrial parks, reserves and protected areas across Australia's landmass. There are currently 82 dedicated IPAs over 87 million hectares of land. There is also around 5 million hectares of Australia's sea areas in dedicated IPAs. Managing IPAs helps First Nations communities protect the cultural features of their country for future generations.

There are no IPAs that overlap the OA or EMBA (refer to Figure 3-25).

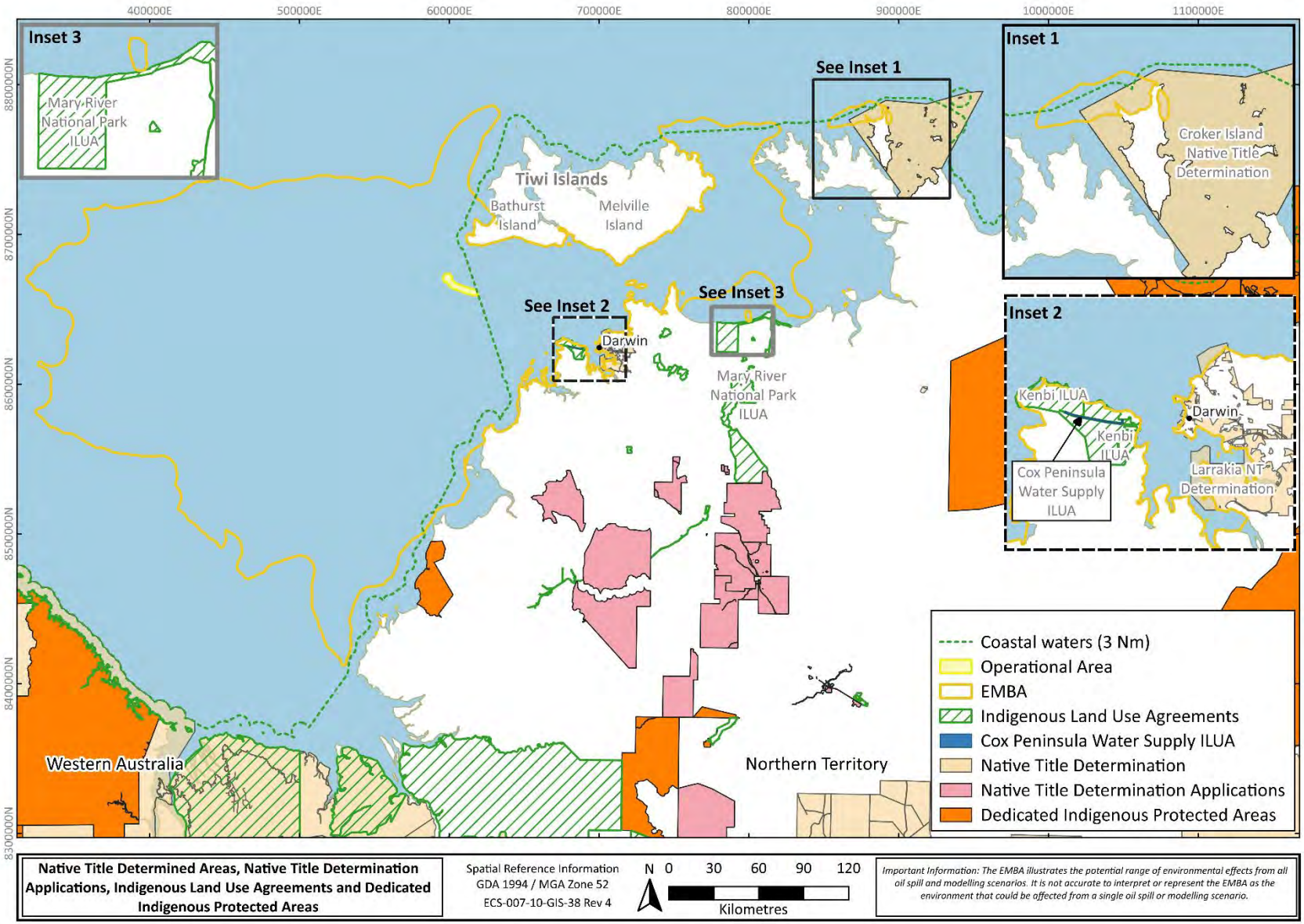

Figure 3-25: Native Title Determined Areas and Applications, ILUAs and IPAs

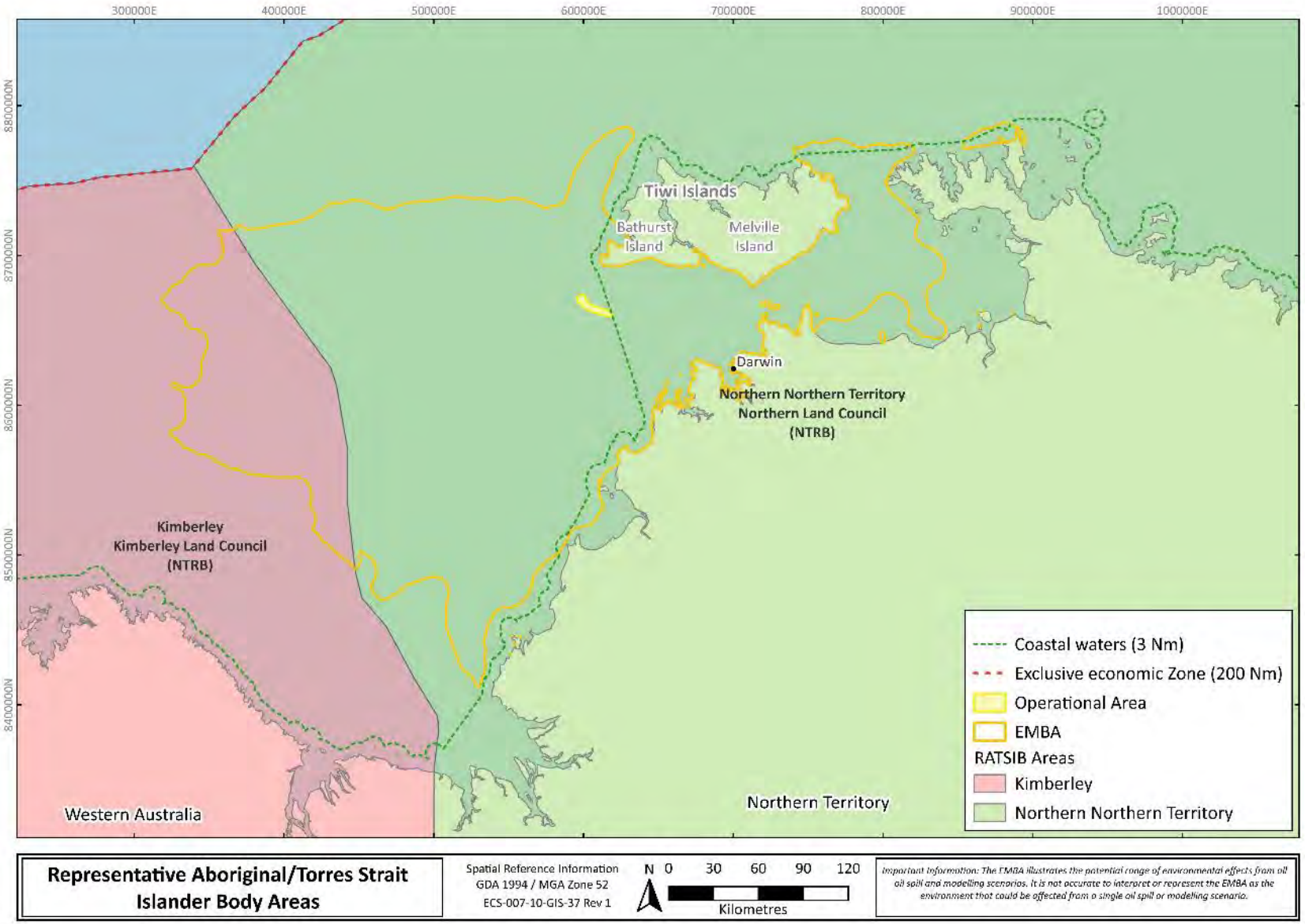

Figure 3-26:Representative Aboriginal/Torres Strait Islander Body Areas

3.2.14.6 Sacred sites

Aboriginal Areas Protection Authority (AAPA) has issued Authority Certificates (C2022-098 and C2024/034) for the DPD (NT) confirming based on AAPA's research findings that there are no sites of significance within the DPD (NT) OA (at least insofar as the extent of NT waters and pursuant to the relevant definitions they are guided by). There are many NT coastal sites along the mainland and island coastlines and potentially the surrounding waters that overlap the EMBA that are protected under the NTASS Act (whether registered, recorded, or not). These sacred sites may include features which lie both above and below the water (AAPA, 2022).

There are extensive coastal areas (down to the low water mark) that intersect the EMBA which are formally recognised as Aboriginal land under the ALR Act.

The Kenbi (Cox Peninsula) Land Claim No. 37 (CoA, 2000) publishes detail on the location and significance of culturally significant First Nations sites within Darwin Harbour and Bynoe Harbour (south-west of Darwin Harbour and separated by the Cox Peninsula), including registered sacred sites. These sites and areas include those used for hunting, fishing, gathering, camping, ceremonies and associated with dreamings. There are numerous sites identified in this report within the EMBA, including those associated with dreamings of totemic marine fauna species, including Ngalwatnyini (manta ray dreaming), Memarrandjamul-nyini (dugong dreaming), Iyn.garrayn-nyini (sea turtle dreaming) (CoA, 2000). The report also identifies 3 sites on the north-eastern side of Darwin Harbour.

All sacred sites in the NT are protected in accordance with the NTASS Act. Sacred sites may be in sea country (whether registered, recorded or not), with access not permitted within 100 metres of any such sacred site, though some sacred sites may have more restrictive access. No sacred sites have been found to be directly impacted by the DPD Project footprint (Corrigan 2024).

Sacred sites may also be protected under the ATSIHP Act, *Heritage Act 2011* (NT), the UCH Act, the ALR Act or the EPBC Act.[24]

3.2.14.7 Land rights

The ALR Act governs Aboriginal land (not native title claims) in the NT. Land that has been granted or recommended for grant under the ALR Act is determined to be held communally by the "traditional Aboriginal owners" of that land. The ALR Act has enabled the establishment of ALTs to hold title to Aboriginal land granted in the NT under that Act.

Aboriginal land rights governed under the ALR Act do not extend past the low water mark of tidal waters overlaying the NT coastline. In coastal areas, grants of Aboriginal land under the ALR Act are made to the low water mark. *Northern Territory v Arnhem Land Aboriginal Land Trust* (2008) 236 CLR 24 confirmed that Traditional Owners of First Nations-owned NT coastline have exclusive access rights to the tidal waters overlying their land.

There is no Aboriginal land either claimed or granted under the ALR Act, or sea closures put into effect in accordance with that Act, that overlap with the OA. The EMBA does overlap areas of land and tidal waters (between the low water mark and the high water mark) granted under the ALR Act. This Aboriginal land is held by the Arnhem Land ALT, the Cobourg Peninsula Sanctuary ALT, the Tiwi ALT, the Kenbi ALT, and the Delissaville/ Wagait/ Larrakia ALT (CoA, 2023).

Section 5(2) of the ALR Act provides that ALTs cannot exercise their functions in relation to land they hold except in accordance with directions given to them by the Land Council for the area in which the relevant land is situated. Where any such directions are given, ALTs must comply with them. Accordingly, ALTs cannot act independently of Land Councils. Under the ALR Act, the functions of Land Councils with respect to ALTs involve administering ALTs in their area, including storing their common seals and deeds of grant, maintaining a register of ALT membership, negotiating agreements on behalf of ALTs and receiving moneys on behalf of ALTs.

The NLC is the relevant Land Council for the Arnhem Land, Cobourg Peninsula Sanctuary, Kenbi and Delissaville/Wagait/Larrakia ALTs, while the TLC is the relevant Land Council for the Tiwi ALT.

3.2.14.8 Marine parks

The EMBA for this EP overlaps with features of the North MPNMP and the North-West MPNMP, which identify natural, cultural and spiritual values associated with AMPs, specifically the Oceanic Shoals AMP and the Arafura AMP.

[24] *For completeness Santos notes that on 23 October 2023 it was informed by the DCCEEW that applications had been received under the ATSIHP Act in relation to certain areas of the sea. Santos understands that these areas are outside the OA but overlap the EMBA. Santos understands that no decisions have been made by the Minister in relation to the applications at the time of writing.*

Santos acknowledges that Commonwealth and State Marine Park Management Plans have sought to recognise cultural interests of First Nations groups. Australian Marine Parks has described this framework as taking 'values into account' when making decisions and taking action in relation to marine parks. Australian Marine Parks summarises these values into natural, cultural, heritage and socioeconomic categories. Additionally, the Commonwealth and State Marine Park Management Plans state that there could be First Nations groups or native title representative groups who may have responsibility for sea country within marine park areas.

3.2.14.9 Cultural fishing, hunting and gathering

First Nations fishing activity in NT waters predominantly occurs within inshore tidal waters. Approximately 80% of NT's coastline is recognised as being under Aboriginal land and sea ownership under the *Aboriginal Land Rights Act 1976* (NT) (NT Government, 2022). Almost all traditional fishing effort (~93%) is concentrated within coastal waters (up to 3 Nm beyond the territorial baseline) of the NT coastline and Tiwi Islands (NT Government, 2017). For the Tiwi Island people, traditional fishing effort is greatest near the larger communities of Wurrumiyanga on Bathurst Island, and Pirlangimpi and Milikapiti on Melville Island (DPIF, 2014).

Traditional subsistence food sources include fish (mullet, mackerel, barramundi, trevally), mud mussels, mud crabs, long bums shellfish, oysters, yams, eggs (turtle and bird), chilli worms, mangrove worms, turtles, stingrays, and dugongs. Green turtles are the main species harvested in the water, while eggs of all turtle species are taken periodically (Tiwi Land Council, 2022). Information provided during Tiwi Clan meetings during consultation for the D&C EP indicated that some Tiwi people have a particular interest in turtles as a traditional food source. Santos was also provided with information during the preparation of the D&C EP from Croker Island members of the community in Minjilang (located outside the EMBA) rely on fish, turtles, dugong, oysters and other marine food sources. During consultation for D&C and this EP, Santos was not provided details about the locations of traditional fishing, hunting and gathering activities.

Traditional subsistence food sources are captured in a culturally appropriate manner learnt from ancestral generations and taught to emerging descendants. This occurs in normal family and community circumstances as well as within the practices of the First Nations groups (Corrigan, 2024).

With the support of the NT Government, Darwin Aquaculture Centre is working with Tiwi People to develop aquacultural enterprises that provide employment and business opportunities (Land Development Corporation, n.d.). Aquacultural options include Barramundi, Trepang, Mud Crab, Prawns, Oysters and Clams (Tiwi Land Council, 2021).

3.2.14.10 Culturally significant marine species

In consultations with Tiwi Clans for the D&C EP, some Tiwi people emphasised that marine turtles are regarded by Tiwi people as totemic and culturally significant species. Therefore, environmental protection measures for marine turtles are important to Tiwi people.

The 2022 Statement of Reasons requests indicated that Tiwi people also consider fish, dugong and whales to hold cultural significance as totemic species (in addition to marine turtles), although the significance of these species was not raised with Santos in its communal consultation sessions with Tiwi people for any of the Barossa EPs.

The Northern Land Council (NLC) in a submission as part of the consultation for the D&C EP indicated a number of marine species that are significant to Aboriginal dreamings including birds, crocodiles, whales, manta rays, crabs, dugong, sea turtle, gropers, sea-eagles, octopus and other turtles. The Corrigan 2024 Report also confirmed that Larrakia people identified turtle, dugong, and stingray dreamings close to Talc Head (within the EMBA) and noting these have significant importance regarding resources and the spiritual dimensions of Larrakia life. Dreamings were identified as being associated with the sea, winds and stars and regarding the moon and the seasons, mermaid dreaming and dreamings near the Charles Point lighthouse.

The Corrigan 2024 Report also identified species important for protection including turtles, crocodiles, dugong, dolphins and the seagrass beds near Kings Table (within the EMBA).

Terrestrial species of cultural significance are outside the EMBA and therefore are not considered further in this EP.

3.2.14.11 Sea country connection

As outlined in Section 3.2.14.1, Santos acknowledges that the cultural features of the environment include the circumstance that First Nations people have spiritual connections to a particular place within that environment, or that the place forms part of the country of a First Nations group, in accordance with the traditional laws and customs of that group. As such, the circumstance that an area of the environment is part of the sea country of a First Nations group, to which members of that group have a spiritual connection, is a cultural feature of that area of the environment.

The North MPNMP (DNP, 2018a) states:

Sea country refers to the areas of the sea that Aboriginal people are particularly affiliated with through their traditional lore and customs. Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years.

The nature of sea country was the subject of extensive lay and expert evidence in the *Munkara* proceeding, to which Santos has had regard in its consideration of cultural features of the environment. Based on this evidence, Santos understands that:

- the concept of country is intimately connected with questions of cultural authority. The First Nations group who is responsible for that area of country has authority to speak in relation to that country, and has custodian responsibilities in respect of that country. One group's area of sea country will end where the next group's begins, although groups may share responsibility for particular Dreamings which traverse different areas of country; and
- sea country connections may manifest in the telling of stories about foundational creation myths explaining features of the landscape or particular species[25].

In order to identify areas of sea country which may be affected by activities under this EP, Santos consulted broadly with First Nations groups and representative organisations both in respect of this EP and its other Barossa EPs. Based on this consultation and Santos' review of publicly available information, Santos has identified that the EMBA likely intersects with sea country, although the geographical extent of sea country interests is inherently indeterminate at this time.

3.2.14.11.1 Features of sea country

In the course of consultation on this EP and previous Barossa EPs, some First Nations Relevant Persons provided additional context as to the manifestation of their sea country connection, being particular stories and creation myths which they believe to be present within the EMBA. Santos acknowledges that expressions of sea country connection may be particular to families and individuals within groups and that there is accordingly divergence in the details of such stories within groups. Notwithstanding this, the information provided is summarised below and has been considered by Santos in the preparation of its EP, including with the benefit of expert anthropological advice.

Dr Corrigan documented a range of views on Tiwi clans' connection with sea country and considered claims for several items to be protected in accordance with Tiwi law and custom (Corrigan, 2023). This included:

- the travels of the Crocodile Man
- the location and existence of a 'Mother Ampitji'
- the travels of Ampitji
- the necessity to look after country in a manner that seeks to ensure no industrial accidents occur which might affect sea country and marine resources (including spiritual connections to the same)
- the Imunka force present in the seas
- the location of a place under the sea where spirits go to upon people's death and then being moved on from the world of the living through Pukamani ceremony.

Tiwi Islanders interviewed by Dr Corrigan about the location of the above items expressed a variety of views. This is supported by the observations and findings of the Court in *Munkara*[26].

The Corrigan 2024 Report also documents input from Larrakia people and relevant First Nations persons from Belyuen and Wagait, who also advise the presence of a range of ancestral beings and dreaming stories of relevance to the Darwin Harbour and surrounding seas. None of these cultural features are known to be associated with any specific or particular places in the DPD Project footprint, but rather have a more general association with the wider area, as well as having associations with particular and specific places outside of the DPD Project footprint.

3.2.14.11.2 Spiritual beings

As part of consultation in the course of preparing the D&C EP some First Nations Relevant Persons expressed cultural connections with sea country in terms of spiritual beings. Information about First Nations cultural beliefs

[25] *Munkara at [866].*

[26] *See Munkara at [871], [1003], [1011]–[1014], [1027] and [1212].*

and connection with their sea country, within and adjacent to the D&C EP EMBA, was provided during First Nations consultation meetings for the D&C EP and from other information provided by NOPSEMA to Santos (2022 Statement of Reasons requests).

During Tiwi Clan consultation meetings for the D&C EP, Tiwi people spoke about the importance of their spiritual dreaming which protects the Tiwi Islands from man-made and natural disasters. Santos recognises that some First Nations Relevant Persons fear sickness or other adverse effects from the actions of spiritual beings in response to impacts on the environment of sea country itself. A key Tiwi creation story concerns a spiritual being (or spiritual beings) called Ampitji (sometimes known as a Rainbow Serpent). The Court in *Munkara* considered lay and anthropological evidence about this creation story at [78]-[81], noting that while there was significant divergence in spiritual beliefs concerning Ampitji, it was not disputed that the spiritual belief in one or more Ampitji is a feature of Tiwi spiritual life and that Ampitji may have a role to play in ensuring compliance with Tiwi law.

During Croker Island consultation meetings in Darwin, Croker Islanders conveyed their affiliation to their land and sea. They advised that their culture is at the coast and includes everything in the water including the marine life. Croker Island people informed Santos during D&C EP consultation about their connections to sea country. Sea country was defined as to the north of Cape Croker out to the deep water (referred to as Inigarrka). Inigarrka is considered the most sacred place in the ocean and the Croker Island people are prohibited from the sacred area. Santos recognises the potential for sea country and songlines to extend into the EMBA for the activity the subject of this EP (see Table 3-18).

In relation to the GEP EP project footprint, Dr Corrigan concluded that, in accordance with Indigenous tradition, there were no specific UCH places along the GEP route that may be affected by the activities under the GEP EP: that there are no known sacred sites or some other specific places that are part of well-known sets of ancestral creation stories amongst the Tiwi people.

The Court in *Munkara* reached a similar conclusion on tangible cultural heritage, finding that the evidence was insufficient to show anything other than a negligible chance that there exists one or more objects of archaeological value along the GEP route[27]. Regarding intangible cultural heritage, the Court found that the evidence before the Court was insufficient to prove that the accounts given by the Applicant's witnesses in relation to specificities of Ampitji and the Crocodile Man were broadly representative of a belief held by the Relevant People as people, such that the belief would constitute a cultural feature[28]. The Court also found that there was insufficient evidence in relation to Imunka [29] to establish that the belief constituted a cultural feature[30].

Whilst these conclusions of the Court and Dr Corrigan were made in relation to activities covered by the GEP EP, the conclusions are also relevant to this EP due to the spatial proximity with the GEP EP activities. That is, no intangible cultural heritage values and sensitivities constituting a cultural feature have been identified at specific places along the GEP and DPD route (on DPD, see Corrigan, 2024).

In its correspondence to Santos of 25 August 2023 in relation to the D&C EP, NOPSEMA drew Santos' attention to 2 reports provided to NOPSEMA by the Environmental Defenders Office (EDO) on behalf of 7 Tiwi Islander clients on 21 July 2023. These reports related to the GEP EP (EDO GEP Reports), which NOPSEMA said may contain information relevant to the EMBA by the Activity covered by this EP. One of the EDO GEP Reports was prepared by Mr Lewis. The Court in *Munkara* doubted the rigor of Mr Lewis' anthropological work and, as referred to above, ultimately found that his opinions constituted him acting as an advocate rather than assisting the Court to arrive at the correct answer[31]. The other EDO GEP Report was prepared by Dr O'Leary. The Court ultimately placed no weight on this report and dismissed it, along with the subsequent reports prepared by Dr O'Leary, for all purposes[32].

The EDO GEP Reports claim to provide an assessment of the locations of potential impacts to Indigenous UCH sites along the GEP route. While the locations of these claimed sites of significance are partially within the Activity EMBA, the locations and significance of these claimed sites as put forward in the EDO GEP Reports is disputed by the Corrigan 2023 Report.

The Corrigan 2023 Report included consideration of detailed expert reports on archaeology and sedimentology along the GEP route conducted by Wessex Archaeology and Dr Posamentier; and the EDO GEP reports. Dr Corrigan concluded there are no specific UCH places along the GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the GEP EP activities

[27] *Munkara at [1306].*
[28] *Munkara at [1003] and [1014].*
[29] *Referred to in Munkara as Yiminga.*
[30] *Munkara at [946].*
[31] *Munkara at [1136]-[1139].*
[32] *Munkara at [879] and [1198].*

(Corrigan, 2023). As the southern section of the GEP extends into the EMBA for this EP, this conclusion also applies to this Activity.

The Corrigan 2023 Report provided the following independent expert comments on the EDO Reports:

- The EDO Reports come to dramatic conclusions about cultural heritage elements in the vicinity of the GEP which overestimate the consistency of the views of the EDO clients with those held by the wider jural public of the Tiwi Islanders;
- Some Tiwi Islanders express views consistent with the EDO Reports, but the authors of those reports failed to consider and take account of other alternative expression;
- The narratives contained in the EDO Reports are not anything like the narratives described to Dr Corrigan in the interviews he undertook;
- The location or even the existence of a mother Ampitji is not agreed by all relevant parties;
- Dr O'Leary (the author of one of the EDO Reports) does not mention any qualification he holds for which he might rely upon to undertake detailed and nuanced ethnographic enquiries in the context of a controversial industrial project;
- Dr O'Leary incorrectly assumes an accuracy of the advice he received about the location of paleo sub-sea burial places;
- The EDO Reports do not correctly identify any specific UCH places along the Barossa GEP Route.

Dr Corrigan also identified a constant theme in his interviews with the Tiwi Islanders that Ampitji travel within the waterholes of the Tiwi Islands and surrounding the Tiwi Islands and the crocodile man, Jirukupai, is also said by some to traverse the seas towards the OA. Dr Corrigan accepts, this is offset where some senior Tiwi people make the point that the OA is, in their view, a long way away from the Tiwi islands and that Jirukupai and Ampitji do not go out that far into the water. Of direct relevance these sorts of Tiwi cultural and spiritual values were tested in the Federal Court and were found not to be consistently spread amongst relevant Tiwi Islanders and in any event did not represent a particular 'place' of cultural and spiritual significance.

An important outcome of Dr Corrigan's research is that no sacred sites or dreamings are shown to be directly impacted by the proposed DPD project footprint, although this is not to say that some persons do not have fears that this could be the case in the event of an unplanned event (Corrigan, 2024).

Santos recognises the importance of cultural and spiritual beliefs to First Nations people. Santos recognises that some First Nations remain concerned about the potential for adverse consequences to First Nations people and natural environment, that may arise as a result of disturbance from the Barossa Gas Project to spiritual dreaming and culturally important spiritual beings. In this regard, Dr Corrigan identified the following recommendation, as put to him by First Nations people:

"*that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities throughout the DPD construction process...*" (Corrigan, 2024)

Dr Corrigan's recommendation is considered further when evaluating impacts and risks to intangible cultural features and adoption of appropriate measures to reduce associated impacts and risks to ALARP and acceptable levels.

3.2.14.12 Summary of cultural features

Cultural features relevant to the Activity—as presented in Sections 3.2.14.1 to 3.2.14.11—are summarised in Table 3-16. Table 3-16 also summarises the context for the identified cultural features, sourced information and an assessment of relevance to the EMBA or OA (if known).

The cultural features presented in Table 3-16 are further assessed in the impact and risk assessment sections (Sections 6 and 7), as applicable. Context for these aspects is described below:

- Cultural heritage protected areas – cultural knowledge and the passing down of cultural education to children can occur from performing of ceremonies and rituals and through dreaming narratives and songlines. Traditional laws and customs amongst a group or groups can define indigenous traditions amongst the group or groups. For example, laws and customs can provide a format for social life and ceremonial matters. The transfer of knowledge of traditional law and customs may be integral to a

group's[33] intangible cultural heritage (UNESCO, 2003) There may be implications to the transfer of First Nations knowledge if, for example, relevant aspects of the environment disappear. Ongoing observance of First Nations traditional laws and customs can also be recognised through Native Title determinations, and knowledge of and connection with country (land and sea) can be recognised through a range of mechanisms including indigenous land use agreements, indigenous protected areas and Aboriginal land rights claims.

- Sacred sites – areas that are traditionally accessed by First Nations people, such as sea country and sacred sites, are important for transferring traditional knowledge and for caring for country. If physical landscapes are altered this could impact the values of sacred sites. Sacred sites and protection of these is a known cultural heritage concern.
- Cultural fishing, hunting and gathering – Through consultation it was identified that a number of marine species provide sustenance to some First Nations people and are obtained through cultural fishing, customary hunting (turtles and dugongs) and gathering (turtle and bird eggs).
- Culturally significant marine species – A range of marine species (such as marine turtles, fish, dugongs, whales, sea-eagle, crocodile and manta rays) were raised during consultation as being important for Aboriginal dreaming, or as having totemic status and significance culturally. The First Nations people maintain a continuing spiritual connection with sea country, through caring for sea country and access to cultural food sources.
- Marine Parks – Commonwealth and State Marine Park Management Plans have sought to recognise cultural interests of First Nations groups within Marine Parks, and the sea country value of Marine Parks to First Nations people.
- Sea country connection through Songlines – Cultural stories and songlines can extend from the shoreline to deep water areas and they tell an important cultural story (Corrigan, 2023 and 2024). If spiritual injury occurs from an activity, some First Nation people believe that songlines can be damaged. It is believed that damaging songlines may have the potential to interfere with ability for First Nation people to reproduce cultural knowledge and continue to provide cultural education of their children.
- Sea country connection through Dreaming sites and stories, and spiritual beings – Some First Nations people believe dreamings relate to powerful creative ancestors who left much of the natural and human world behind them as they travelled (Corrigan, 2023 and 2024). It is believed ancestors can travel to areas such as in the water or land below the seas, where these ancestors continue to use these areas. Some First Nations people are of the opinion that if spiritual injury is caused it can damage dreaming tracks. They believe it is their responsibility to look after these dreaming sites to protect the known travels of the spiritual beings. Information provided to Santos by First Nations communities during consultation, also highlighted the importance of cultural spiritual beings, such as Ampitji, as protectors of First Nations communities, and that if spiritual beings are upset or offended it can result in natural disasters or sickness among First Nations communities.

[33] *As noted in Munkara v Santos NA Barossa Pty Ltd (No 3) [2024] FCA 9, this cultural heritage must be held communally by the group, although need not be the subject of consensus.*

Table 3-18: Summary of cultural features and heritage values

Identified cultural feature	Description	EP Source	OA presence	EMBA presence
Archaeological heritage				
First Nations UCH	A First Nations archaeological assessment for the DPD Project Area was based on a detailed geomorphological assessment. This study focussed on the likelihood for deposits associated with the Last Glacial Maximum (LGM) to be impacted by the DPD Project. Only one location where potential sediments associated with the LGM were indicated was in the vicinity of KP36.4 to 37.9 (outside of the OA). At this location, potential sediments are assessed likely to be at a depth of approximately 18 m below the sea floor. At this depth, no activities related to the construction of the DPD project will have any direct or indirect impact on these potential sediments. In any event, the location of the potential sediments associated with the LGM is outside the OA. There are no declared protected First Nations UCH sites within the OA.	Desktop First Nations Archaeological Assessment Report: Darwin Pipeline Duplication Project, (OzArk, 2024)	No	Possible (not declared or spatial extent undefined)
Tangible values				
Native title	First Nations people have interests in an area of land and/or water according to its traditional laws and customs, as recognised through cultural heritage legal and regulatory frameworks. There are no native title claims or determinations that overlap with the OA; however the EMBA intersects the Croker Island and Larrakia native title determinations (refer to Figure 3-25). The areas of responsibility for regional native title representative bodies that overlap the EMBA are shown in Figure 3-26.	Spatial datasets were downloaded from the National Native Title Tribunal website[34] and confirmed during consultation with First Nations people and representative groups (Sections 3.2.14.3 to Section 3.2.14.7).	No	Yes
Indigenous land use agreements	There are no ILUAs within the OA; however the EMBA does overlap the areas of land and tidal waters (between the low water mark and the high water mark) of the Kenbi and Mary River ILUAs (refer to Figure 3-25).		No	No
Indigenous protected areas	There are no IPAs that overlap the OA or EMBA (refer to Figure 3-25).		No	No
Sacred Sites	There are no known registered sacred or First Nations UCH sites within the OA. There are many NT coastal sacred sites along the mainland and island coastlines and potentially the surrounding waters that overlap the EMBA.	Consultation feedback and Corrigan 2024 Report including a view of extensive ethnographic studies (Section 3.2.14.6).	No	Yes
Land rights	There is no Aboriginal land either claimed or granted under the ALR Act, or sea closures put into effect in accordance with that Act, that overlap with the OA. The EMBA does overlap areas of land and tidal waters (between the low water mark and the high water mark) granted under the	CoA, 2023 (Section 3.2.14.7)	No	Yes

[34] *Source:* http://www.nntt.gov.au/assistance/Geospatial/Pages/Spatial-aata.aspx

Identified cultural feature	Description	EP Source	OA presence	EMBA presence
	ALR Act. This Aboriginal land is held by the Arnhem Land ALT, the Cobourg Peninsula Sanctuary ALT, the Tiwi ALT, the Kenbi ALT, and the Delissaville/ Wagait/ Larrakia ALT.			
Marine Parks	The North MPNMP and the North-West MPNMP identify natural, cultural and spiritual values associated with AMPs, specifically the Oceanic Shoals AMP and the Arafura AMP.	DNP, 2018a; 2018b. (Section 3.2.14.8)	No	Yes
Cultural fishing, hunting and gathering	Cultural fishing, hunting and gathering of marine species such as fish, shellfish, turtles, dugongs, eggs (turtle and seagull).	Corrigan 2024 Report and consultation with First Nations people and representative groups (Section 3.2.14.9).	Possible (spatial extent undefined)	Yes
Culturally significant marine species	First Nations persons and groups that have a deep connection with the sea through totems and dreamings such as marine fauna (marine turtles, whales, dugong) and consider them to be of cultural significance.	2022 Statement of Reasons requests and NLC consultation feedback in relation to the D&C EP (Section 3.2.14.10). Consultation feedback and Dr Corrigan reports (2023, 2024) including a view of extensive ethnographic studies.	Yes	Yes
Intangible values				
Sea country connection through Songlines	Songlines can go from land to sea and were identified as important by the Croker Island and Tiwi Islands people, as well as Larrakia people and other First Nations peoples with interests in the DPD Project route. They ordinarily traverse areas in a manner of travelling from named places to named places.	Consultation feedback and Corrigan reports including a view of extensive ethnographic studies (Section 3.2.14.11).	Possible (spatial extent undefined)	Possible (spatial extent undefined)
Sea country connection through Dreaming sites and stories and spiritual beings	*Dreaming* Dreamings were identified as being associated with the sea, winds and stars and regarding the moon and the seasons, mermaid dreaming and dreamings near the Charles Point lighthouse. A number of marine species are significant to Aboriginal Dreaming such birds, crocodiles, shellfish, whales, manta rays, crabs, dugong, sea turtle, gropers, sea-eagles and octopus.	Consultation feedback and Dr Corrigan reports (2023, 2024) including a view of extensive ethnographic studies (Sections 3.2.14.10 and 3.2.14.11). NLC consultation feedback in relation to the D&C EP (Section 3.2.14.10).	Possible (spatial extent undefined)	Possible (spatial extent undefined)
	Spiritual beings Spiritual beings are important to Croker Island people and Tiwi Island people, as well as Larrakia people and other First Nations peoples with interests in the DPD Project route for their role as protectors of First Nations people and the natural environment. Spiritual beings are believed to be present in the vicinity of the islands.	Consultation feedback and Dr Corrigan reports (2023, 2024) including a review of extensive ethnographic studies (Section 3.2.14.11).	Possible (spatial extent undefined)	Possible (spatial extent undefined)

4. Consultation

4.1 Consultation background

Santos has continued to undertake consultation with Relevant Persons throughout various phases of the Barossa Gas Project to date in compliance with OPGGS(E)R consultation requirements, applicable case law and applicable guidance (e.g. NOPSEMA guidance issued in May 2023 and subsequent guidance in May 2024), building on Santos' recent history of Relevant Persons consultation in the region for exploration, construction, operations and decommissioning activities.

Recent Relevant Persons consultation under the OPGGS(E)R has been undertaken for the following Santos EPs for activities in waters offshore from the NT. Where relevant, feedback provided for these EPs has been used to inform preparation of this EP:

- OPP (including through ConocoPhillips, as previous operator of the Barossa Development)
- GEP EP (including through ConocoPhillips, as previous operator of the Barossa Development)
- D&C EP
- SURF EP
- Bayu-Undan Gas Export Pipeline EP
- Eos 3D Marine Seismic Survey EP
- Tern-2 Wellhead Abandonment EP.

Santos has also undertaken consultation in compliance with relevant OPGGS(E)R requirements in relation to the NT coastal waters aspects of the Darwin Pipeline Duplication Offshore Construction Environmental Management Plan (NT coastal waters) (DPD Offshore CEMP). As the EMBAs for the activity in NT coastal waters (covered by the DPD Offshore CEMP) and Commonwealth waters (covered by this EP) are the same, information provided during consultation on NT coastal waters aspects of the DPD Offshore CEMP has been considered to determine its relevance to this EP. Where relevant, that information has been addressed in this EP.

4.2 OPGGS(E)R consultation requirements

Table 4-1 and Section 8.11 outline the applicable OPGGS(E)R requirements for consultation with Relevant Persons for this EP.

Table 4-1: Consultation requirements under the OPGGS(E)R

OPGGS(E)R 2023 Requirements
Section 24. Other information in the environment plan
The environment plan must contain the following: b. a report on all consultations under section 25 of any relevant person by the titleholder, that contains: i. a summary of each response made by a relevant person; and ii. an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and iii. a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and iv. a copy of the full text of any response by a relevant person.
Section 25. Consultation with relevant authorities, persons and organisations, etc
(1) In the course of preparing an environment plan (including a revised environment plan referred to in Division 5) a titleholder must consult each of the following (a ***relevant person***): a. each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant; b. if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister; c. if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister; d. a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan;

e. any other person or organisation that the titleholder considers relevant. (2) For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person. (3) The titleholder must allow a relevant person a reasonable period for the consultation. (4) The titleholder must tell each relevant person the titleholder consults that: a. the relevant person may request that particular information the relevant person provides in the consultation not be published; b. information subject to such a request is not to be published under this Part.
Section 26. Submission of environment plan
Form of environment plan (8) All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under section 25 in the course of preparation of the plan, must be contained in the sensitive information part of the plan and not anywhere else in the plan. Note: Subparagraph 24(b)(iv) requires the plan to contain a copy of the full text of any response by a Relevant Person to consultation under section 25 in the course of preparation of the plan.
Section 28. Publishing environment plan and associated information
(1) If NOPSMEA's provisional decision under section 27 is that the environment plan includes material apparently addressing all the provisions of Division 2 (Contents of an environment plan), NOPSEMA must publish on NOPSEMA's website as soon as practicable: a. the plan with the sensitive information part removed; and b. the name of the titleholder who submitted the plan; and c. a description of the activity or stage of the activity to which the plan relates; and d. the location of the activity; and e. a link or other reference to the place where the accepted offshore project proposal (if any) is published; and f. details of the titleholder's nominated liaison person for the activity.

4.3 Government and industry guidance

Santos has considered the following NOPSEMA guidance in developing its consultation activities and approach:

- GL2086 – Consultation in the course of preparing an environment plan (EP Consultation Guideline) (NOPSEMA, 2023; 2024)
- GN1847 – Responding to public comment on Environment Plans (NOPSEMA, 2022a)
- GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area (NOPSEMA, 2024)
- GL1721 – Environment plan decision making (NOPSEMA, 2024c)
- GN1344 – Environment plan content requirement (NOPSEMA, 2024b)
- GN1488 – Oil Pollution Risk Management (NOPSEMA, 2021)
- *Supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth marine area* (Australian Government, 2022) jointly released by NOPSEMA, the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF), the Commonwealth Department of Industry, Science and Resources (DISR), and AFMA.
- Petroleum activities and Australian Marine Parks: A guidance note to support environmental protection and effective consultation (Australian Government, 2023) jointly released by NOPSEMA and Parks Australia.

Santos has also considered other government and industry guidance, including:

- International Standards Organisation
  - ISO14001:2015 Environmental Management Systems
- AFMA
  - Petroleum industry consultation with the commercial fishing industry
- Australian Heritage Commission

    - Ask First - A guide to respecting Indigenous heritage places and values
- DAFF
    - Fisheries and the Environment – OPGGS Act
    - Offshore Installations–Biosecurity Guide (DAFF, 2023a)
- DCCEEW
    - Interim Engaging with First Nations People and Communities on Assessments and Approvals under the *Environment Protection and Biodiversity Conservation Act 1999* (DCCEEW, 2023c)
    - Engagement with DCCEEW regarding the protection of any possible underwater cultural heritage under the *Underwater Cultural Heritage Act 2018* (Cth)
- Commonwealth Ministerial Council on Mineral and Petroleum Resources
    - Principles for Engagement with Communities and Stakeholders
- International Association for Public Participation
    - Quality Assurance Standard for Community and Stakeholder Engagement
- WA Department of Primary Industries and Regional Development Guidance statement for oil and gas industry consultation with the Department of Fisheries
- WA Department of Transport
    - Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements
- Western Australian Fishing Industry Council (WAFIC)
    - Commercial Fishing Consultation Framework for the Offshore Oil and Gas Sector - https://www.wafic.org.au/wp-content/uploads/2023/07/Oil-and-Gas-Consultation-Framework.pdf
    - Consultation approach for unplanned events - https://www.wafic.org.au/what-we-do/access-sustainability/oil-gas/consultation-approach-for-unplanned-events/

4.4 Applicable case law and guidance

In addition to considering the regulatory requirements and guidance set out above, in conducting Relevant Person consultation for the activities covered by this EP, Santos has considered the judgments of:

- Justice Bromberg in Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No. 2) [2022] FCA 1121;
- the Full Federal Court in Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (Appeal Judgement); and
- Justice Calvin in Cooper v National Offshore Petroleum Safety and Environmental Management Authority (No 2) [2023] FCA 1158.

The EP Consultation Guideline (NOPSEMA, 2023; 2024) provides a summary of the Full Federal Court's interpretation of “functions”, “activities” and “interests” referenced in section 25(1)(d) of the OPGGS(E)R, adopted by NOPSEMA to assist in informing who may be a Relevant Person and how Relevant Persons may be identified, as defined in Table 4-2.

Table 4-2: Relevant person terms and definitions

Term	Interpretation
Functions	Refers to “a power or duty to do something”
Activities	To be read broadly and is broader than the definition of “activity” in section 5 of the OPGGS(E)R and is likely directed to what the Relevant Person is already doing
Interests	To be construed as conforming with the accepted concept of “interest” in other areas of public administrative law. Includes “any interest possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation”

Santos has also had regard to the purpose of consultation as outlined in the Appeal Judgment and EP Consultation Guideline (NOPSEMA, 2024), the emphasis that superficial or tokenistic consultation is not sufficient and that:

- consultation must be appropriate and adapted to the nature of each Relevant Person;
- for each Relevant Person, the appropriate manner and method of consultation (including the nature of information, time periods for consultation and mode of communication) may differ; and
- there is good reason to adopt pragmatic and practical approaches to consultation conducted in accordance with section 25 of the OPGGS(E)R.

4.5 Santos' consultation methodology

4.5.1 Overview

Santos consults to ensure that any activity it is proposing under an EP is carried out in a manner:

- consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and
- by which the environmental impacts and risks of the Activity will be reduced to ALARP and to an acceptable level.

The consultation process is designed to assist Santos to further ascertain, understand and assess values and sensitivities of the environment (including ecosystems, including people and communities, natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places) that may be affected by a proposed activity, and the potential environmental impacts and risks, through information obtained during consultations.

Santos may then refine or change its proposed control measures to address potential environmental impacts and risks of the activity based on that information or any claims or objections raised through consultation.

Santos' consultation methodology and process adopted in developing this EP comprised the following key steps:

- identifying potential Relevant Person categories;
- identifying Relevant Persons;
- providing opportunities for Relevant Persons to identify themselves if they wished to be consulted (e.g. through advertising, encouraging identified Relevant Persons to identify other potential Relevant Persons);
- consultation planning and preliminary consultation activities;
- consulting Relevant Persons;
- assessing the merits of objections or claims made by Relevant Persons about the adverse impact of each activity to which the EP relates;
- providing responses to queries, requests and feedback.

As described below, Santos considered the spatial extent of the EMBA by the Activity and the particular aspects of the relevant environment as part of its process for identifying Relevant Persons.

4.5.2 Identifying Relevant Persons

This section outlines the methodology and steps that Santos has used to identify Relevant Persons.

Santos considered the nature and location of the activity (and key component activities) (described in Section 2), the impacts of planned events and the risks of unplanned events (described in Section 6 and Section 7).

Santos also considered the spatial extent of the EMBA by the activity (refer to Section 3.1.1) and the particular aspects of the relevant environment (refer to Section 3.2) as part of its process for identifying Relevant Persons.

The identification of Relevant Persons was an iterative process. Table 4-3 summarises the preliminary steps adopted by Santos to identify Relevant Persons.

Table 4-3: Preliminary identification methodology

Process steps
1. Identify the impacts of the planned activities and the risks and impacts of unplanned events.
2. Consider the spatial extent of the EMBA by the Activity impacts and risks.
3. Consider and identify aspects of the environment within the environment that may be affected, having regard to:

Process steps
(a) ecosystems and their constituent parts, including people and communities (b) natural and physical resources (c) the qualities and characteristics of locations, places and areas (d) the heritage value of places (e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).
4. Identify Relevant Person categories, having regard to: (a) aspects of the environment identified at Item 3 (b) the departments or agencies of Commonwealth, State and Territory governments that could therefore be relevant (c) the kinds of functions, interests or activities of people or organisations that could therefore be affected (d) submissions received in response to Santos' advertisements asking Relevant Persons to identify themselves if they wished to be consulted (e) any other person or organisation that the titleholder considers relevant. Update during consultation based on new information, if appropriate.
5. Identify Relevant Persons within Relevant Person categories, having regard to items 1–4 above.

Table 4-4 outlines the environmental aspects within the EMBA (described in detail in Section 3). Santos considered these aspects for the purpose of identifying Relevant Person categories.

Table 4-4: Environmental aspects considered for Relevant Person category identification

Aspects of the environment	EP Reference
Physical environment	Section 3.2.2
Provincial bioregions	Section 3.2.1.1
Benthic habitats	Section 3.2.8
National heritage place and world heritage property	Section 3.2.11.1
Marine parks	Section 3.2.11.2
Wetlands of international and national importance	Section 3.2.11.3
Key ecological features	Section 3.2.11.4
Threatened and migratory fauna	Section 3.2.12
Biologically important areas and critical habitat	Section 3.2.12.5
Conservation advice, recovery plans and management plans	Section 3.2.12.6
Commercial fisheries	Section 3.2.13.1
Energy industry	Section 3.2.13.2
Defence activities	Section 3.2.13.3
Telecommunications cables	Section 3.2.13.4
Shipping	Section 3.2.13.5
Recreation and tourism	Section 3.2.13.6
Underwater cultural heritage	Section 3.2.13.7
Cultural features	Section 3.2.14

The consideration of the environmental aspects resulted in identification of the following Relevant Person categories:

- Section 25(1)(a)(b)(c) of the OPGGS(E)R:
  - Commonwealth Government agency or authority;
  - NT Government agency or authority; and
  - WA Government agency or authority.
- Section 25(1)(d)(e) of the OPGGS(E)R:
  - academic and research organisations;

- commercial fishing (Commonwealth-managed);
- commercial fishing (NT–managed);
- commercial fishing (WA–managed);
- energy industry titleholders/operators;
- environmental conservation organisations;
- First Nations people and groups;
- infrastructure operators;
- industry associations;
- local government and recognised community reference/liaison groups;
- recreational fishing;
- shipping; and
- tourism operators.

Santos then undertook the actions outlined in Table 4-5 to identify Relevant Persons within those categories. No action was required for the identification of international Relevant Persons for this EP as the EMBA does not enter international waters.

Table 4-5: Actions for identifying Relevant Persons by category

Relevant Person Category	Actions to identify Relevant Persons
All Relevant Person categories	• Review of relevant regional historical consultation by Santos in the region, including all previous Barossa EPs. • Review of identified Relevant Persons in publicly available EPs submitted by other Titleholders that may be relevant to proposed activities to be managed under this EP. • Conducting key-word searches using online search engines and reviewing media coverage and organisation websites to identify persons and organisations with reasonably ascertainable functions, interests and activities that may be affected by the activities under this EP. • Regional advertising as outlined in Section 4.5.9. • Review of information provided by or claims made by or on behalf of organisations who claimed to be Relevant Persons
Section 25(1)(a) of the OPGGS(E)R	
Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of NOPSEMA and government agency guidance on consultation expectations.
Section 25(1)(b) and (c) of the OPGGS(E)R	
State and Territory Departments/Agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of NOPSEMA and government agency guidance on consultation expectations.
Section 25(1)(d) and (e) of the OPGGS(E)R	
Academic and research organisations	• Conducting key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests or activities that may be affected, having regard to the region, activities or risks/impacts under this EP.
Commercial fishing	• Review of Commonwealth, NT and WA Government commercial fishing catch and effort data. • Review of fisheries entitled to fish in the EMBA.
Energy industry	• Review of EMBA overlap with petroleum, greenhouse gas and any other NOPTA issued titles.

Relevant Person Category	Actions to identify Relevant Persons
Environmental conservation organisations	• Conducting key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests or activities that may be affected, having regard to the region, activities or risks/impacts under this EP. • Review of other publicly available information, e.g. websites of conservation organisations whose functions, interests or activities within the EMBA may be affected.
First Nations people and groups	• Review of the Judgment and the Appeal Judgment. • Review of EMBA overlap with Native Title determined areas and claims, ILUAs, registered / protected sacred sites, land rights and IPAs. • Review of Representative Aboriginal/Torres Strait Island Bodies (RATSIBs) on Native Title website. • Review of prescribed bodies corporate on Native Title website, where relevant. • Conducting searches of public cultural heritage databases relevant to the EMBA. • Review of marine park management plans relevant to the EMBA. • Review of additional publicly available information sources, where relevant. • Engagement with government departments/agencies with relevant knowledge or relevant responsibilities. • Engagement with representative bodies under the NT Act and the ALR Act. • Engagement with other representative organisations in areas of potential relevance to Barossa Project activities such as liaison committees and First Nations Consultative Committees (FNCCs). • Engagement with third party consultants to assist with identification of potential First Nations Relevant Persons.
Infrastructure operators	• Review of EMBA overlap with offshore and onshore infrastructure, such as submarine telecommunications cables or ports.
Industry associations	• Review of industry representation of the following Relevant Person groups: – commercial fishing – local government authorities – local industry – recreational fishing – shipping – tourism operators.
Local government and recognised community reference/liaison groups	Review of EMBA overlap with boundaries of local government areas.
Recreational fishing	• Review of EMBA overlap with areas of interest to recreational fishing. • Review of potential presence of recreational fishing club members in the EMBA. • Review of website information of relevant agencies/organisations that represent recreational fishing interests.
Tourism operators	• Review of EMBA overlap with areas of interest to charter and tourism operators. • Review of potential presence in the EMBA. • Review of website information of relevant operators/organisations that represent commercial tourism interests.

4.5.3 Public awareness campaign and self-identification opportunities

In addition to undertaking the process for identification of potential Relevant Persons, as described above, Santos undertakes a range of activities to promote opportunities for other organisations or individuals to self-identify as potential Relevant Persons if they feel that their functions, interests or activities may be affected.

These promotional activities include public information campaigns using a range of appropriate media, including, radio, print media, targeted social media and drop-in meetings where information about the proposed activities is

provided. Details of the public information campaign for this EP, including targeted efforts to ensure First Nations organisations and individuals are provided the same opportunities, are described in Section 4.5.4 and a schedule of advertising is included in Table 4-6. Santos also has an online self-nomination form on its Consultation Hub website, where fact sheets and other consultation materials are published and available for download.

The media and advertising campaign had a regional focus, noting the remoteness of First Nations and other communities in Northern Australia. Social media and/or radio advertising were seen as useful tools to raise awareness in First Nations communities about the proposed Activity and associated consultation opportunities given the known widespread use in these communities of mobile smartphones and social media platforms.

Such activities provide a more than reasonable opportunity for organisations and individuals to self-identify as a Relevant Person for the purpose of OPGGS(E)R section 25 consultation, where they consider themselves to have interests, functions or activities that may be affected by the planned activities and for Relevant Persons to provide their input.

Santos' process involves the provision of reasonable timeframes for the self-identification or nomination of others as Relevant Persons, for Relevant Persons to consider consultation information, ask questions and give their input and for Santos' consideration and assessment of the merits of objections and claims.

4.5.4 Identification and consultation with First Nations people and groups

In addition to the public awareness campaign and self-identification opportunities outlined above, Santos has developed a comprehensive process for identifying and undertaking effective consultation with First Nations Relevant Persons.

As with Santos' process for identifying Relevant Persons generally, this is an iterative process with multiple avenues of enquiry including, but not limited to, the following actions:

- Active steps to identify First Nations people and groups as per actions outlined in Table 4-5, including advertising broadly to ensure that Relevant Persons that are not otherwise identified by Santos' examination of the EMBA are given the opportunity to self-identify.
- Providing opportunities for Relevant Persons to provide input in EP development, including:
    - Registered Native Title Prescribed Bodies Corporate (PBCs), groups associated with Native Title Determinations and groups in active Native Title Claims;
    - Native Title Representative Bodies;
    - Groups who may be parties to Indigenous Protected Areas, or named in Indigenous Land Use Agreements;
    - Existing liaison committees or reference groups, where these committees or groups have been established between Native Title Parties, Native Title Representative Bodies and industry/government;
    - Supporting the establishment of liaison committees or groups that are intended to be representative and able to speak on behalf communities where formal structures do not exist, and consulting such committees or groups;
    - Individual First Nations people who self-identify as relevant (if any); and
    - Asking identified persons if there are other persons or organisations who may be a Relevant Person.

Santos' process involved identifying First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA and asking itself the following questions in order to positively identify First Nations Relevant Persons:

- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any native title claims pending or determined (or any ILUA) that extend offshore and cross into the EMBA?
- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any responsibilities for sacred sites that extend offshore and cross into the EMBA (recognised and protected under the ALR Act, the NTASS Act, the ATSIHP Act, the UCH Act, or the EPBC Act).
- Do any First Nations groups, clans and/or organisations along the NT/WA coastline in the vicinity of the EMBA have any land rights (apart from native title claims) pending or determined that extend offshore and cross into the EMBA?
- Are there any IPAs that extend offshore and cross into the EMBA?

If the answer to any of the above questions was Yes, this would have resulted in identification of the particular First Nations group, clan or organisation as a Relevant Person.

Santos recognises that not all relevant functions, interests or activities of First Nations persons or groups will be identified through the four steps above, and that even if the answer to all four of the above questions is no, First Nations groups in the vicinity of the EMBA could still potentially have communal cultural interests (such as connection to sea country) that extend into the EMBA. However, the EMBA includes large areas where only unplanned activities such as a spill event with very low probability of occurrence, could have any impact on the environment.

The context for how the spatial extent of the EMBA is determined is relevant when evaluating whether any First Nations sea country or other interests could potentially be affected by the activity. In the case of this EP, the EMBA is informed by modelling the maximum potential extent of all major unplanned spill events under all seasonal conditions as further explained in Section 3.1.1. There is no single event that could ever result in the whole EMBA being affected at the same time. The modelling itself represents the potential extent of detection of a spill in the environment rather than the extent of environmental impact on receptors in the environment, for example impacts to marine species which may be of cultural/totemic significance to First Nations communities.

The EMBA also does not take into account implementation of spill response mitigation measures, as included in vessel spill response plans and the OPEP (BAS-210 0131), which would reduce the size of the EMBA by a spill in any scenario. This means the EMBA is an overly conservative representation of the full extent of the EMBA. When considering the remote possibility of any major unplanned spill event, and the inherent conservatism of the EMBA, the likelihood of First Nations communities along the Northern Australia NT/WA coastline having an interest that may be affected by the proposed activities (if such groups do have sea country or other interests) becomes increasingly unlikely with increasing distance from the OA, where planned activities will occur.

It is relevant to note that the outermost boundary of the EMBA for the activity covered by this EP is approximately 65 km from the WA coastline, and the WA coastline is approximately 328 km from the OA at its closest point. Nonetheless, having regard to the residual potential for other cultural interests within the EMBA, Santos supplemented its 4-step process above by:

- the completion of First Nations Relevant Persons identification steps (see Table 4-5)
- including the NLC and the Kimberley Land Council (KLC) as Relevant Persons, including in their capacity as Native Title Representative Bodies who would have knowledge about any sea country interests of coastal First Nations communities along the WA/NT coastlines in the vicinity of the EMBA and inviting their input on First Nations Relevant Persons;
- inviting information from identified First Nations Relevant Persons (including the NLC and KLC) as to other potential First Nations Relevant Persons; and
- conducting public awareness and advertising campaigns targeted at increasing awareness of the Barossa Gas Project and the DPD Project activity; and encouraging any First Nations Relevant Persons who have not been identified to come forward (see Table 4-6 and Table 4-9).

These steps were carried out to further inform Santos' identification of First Nations people or groups with reasonably ascertainable functions, interests or activities that may be affected by the activities to be carried out under this EP. Santos' process for identifying Relevant Persons involved including in its consultation materials an invitation for Relevant Persons to notify Santos of other potentially Relevant Persons for Santos to consider consulting about this EP. Santos was not directed to any other First Nations groups or organisations in response to this invitation, other than those Santos had identified.

Santos utilised the advertising and awareness campaign (see Section 4.5.4.3) to assist in identification of other First Nations groups with interests (such as connection with sea country) that may be affected by the Activity, that weren't identified through other identification steps described above and in Table 4-5. While Santos recognises that the obligation to identify Relevant Persons lies on the titleholder, and titleholders cannot rely solely on a process of public notification and self-identification, Santos considers its campaign to be an appropriate measure to promote comprehensive identification of First Nations (and other) Relevant Persons, particularly having regard to the remoteness of the activity, the remote possibility of a major unplanned spill event, the inherent conservatism in spill modelling used to inform the EMBA and the difficulty in ascertaining whose interests may be affected in remote offshore waters.

For this EP, Santos has provided consultation opportunities and supporting information to organisations and clan groups listed in Table 4-7, acknowledging the use of a highly conservative EMBA (as described in Section 3) for the purpose of assisting to identify potentially Relevant Persons.

This conservative approach has ensured a very broad capture of potential interested Relevant Persons and provided them an opportunity to provide input if they feel they may be impacted. The consultation process with each category of First Nations organisations and individuals is further explained below:

- Consulting First Nations people through existing representative organisations, including Registered Native Title Bodies Corporate, groups associated with Native Title Determinations and groups in active Native Title Claims, Native Title Representative Bodies, and groups who may be parties to Indigenous Protected Areas, or be named in ILUAs;
- Consulting First Nations people through existing liaison committees or reference groups that have been established between Native Title Parties, Native Title Representative Bodies and industry/government;
- Supporting the establishment of liaison committees or groups that are intended to be representative and able to speak on behalf communities where formal structures do not exist and consulting such committees or groups; and
- Working with First Nations groups and people to develop culturally appropriate consultation methods reflecting the information needs of each First Nations group. By way of example, Santos held multiple community consultations with Tiwi people at the community's request for previous Barossa EP consultation.

In addition, Santos undertakes a range of activities to promote opportunities for First Nations people to provide input during consultation to support identification and evaluation of environmental impacts and risks for proposed activities and develop appropriate measures to reduce these to ALARP and to an acceptable level.

These promotional activities include public information campaigns using a range of appropriate media, including, radio, print media, targeted social media, drop-in meetings with information about the project activities and inviting people to self-identify as a Relevant Person in response, where they considered themselves to have interests, functions or activities that may be affected by the planned activities. Details of the public information campaign for this EP are included in Table 4-8 and a schedule of advertising is included in Table 4-9.

Santos has supported the establishment of FNCCs with the intention that these be self-nominating and self-governing and independent of government or industry (refer Section 4.5.5). The activities of these committees are complementary to the functions and responsibilities of representative organisations, such as Land Councils or other formal bodies, with the intention that they be in a position to speak on behalf of communities with respect to traditional lands and waters.

Santos has supported the establishment of these FNCCs in part as a response to the growing need for a means for First Nations voices to be heard and considered.

Following the provision of the Corrigan 2024 report, Santos confirmed that Corrigan's survey participants were already considered in Santos' relevant persons identification process.

4.5.4.1 Consultation with existing representative organisations

Consultation effort in the NT with existing representative organisations has focused on providing input and feedback opportunities for the NLC and TLC, as well as Aboriginal Corporations, including the Larrakia Nation Aboriginal Corporation, Larrakia Development Corporation and Gwalwa Dariniki Association given the proximity of their interests to the OA and the EMBA.

Consultation effort in WA with existing representative organisations has focused on providing input and feedback opportunities for the KLC as the EMBA intersects the Kimberley representative Aboriginal/Torres Strait Islander body (RATSIB) area (refer Figure 3-26). As a RATSIB, the KLC has responsibility for providing services to native title parties in the Kimberley, noting that for this EP the EMBA does not intersect the native title interests of PBCs in this region. Further, the OA is more than 300 km from these interests.

4.5.4.2 Consultation with Larrakia people

A key mechanism for ongoing consultation by Santos with the Larrakia people is through the Wickham Point Deed liaison committee which includes representation of Larrakia family groups. The Wickham Point Deed was entered into between Darwin LNG and the NLC (which is also identified as a Relevant Person in Table 4-7) on 29 April 1999 and the liaison committee represents a long-running dialogue between Santos and Larrakia Traditional Owners. Santos coordinates quarterly Wickham Point Deed liaison committee meetings and the functions of the committee include making recommendations to Santos on various matters such as environmental, cultural heritage, employment and business opportunities.

Santos has discussed the DPD Project with the Wickham Point Deed liaison committee as a regular agenda item from November 2021 onwards, including providing information on Project activities, approval requirements, impacts and risks, the AAPA Authority Certificate process and proposed management measures.

The Wickham Point Deed liaison committee has been identified as a Relevant Person for consultation with respect to activities within this EP (refer Table 4-7), with a consultation session held on 28 November 2023 covering the following:

- an overview of Santos and the Barossa Project
- relevant Commonwealth and NT regulations and approvals required for DPD activities
- the activities covered by this EP, including installation steps and vessel descriptions
- the environmental impacts and risks involved with the planned activities and planned controls to manage those risks
- the EMBA in the event of an unplanned event, the risks and planned controls to manage those risks
- the regulatory consultation processes and privacy provisions.

The information booklet and NOPSEMA consultation brochure were also provided at the consultation session. The session was conducted in person and visual aids, maps, videos and animations were used to present information regarding the activity and the project more generally.

Further detail on this consultation session is provided in Table 4-10.

In order to reach out to Larrakia people, additional to the families represented on the WPDRC, Santos requested assistance from the Larrakia Nation Aboriginal Corporation (LNAC) (Table 4-9). The LNAC was set up to provide a corporate identity for Larrakia people to uphold Native Title claims and has grown to represent the Traditional Owners of the Darwin region and to speak on behalf of Larrakia people while delivering community and outreach services to the broader Darwin community.

In addition to consulting with the LNAC in its own right, Santos consulted with the LNAC to obtain its advice on the best way to directly consult with Larrakia People for the purpose of this EP in a culturally sensitive and appropriate way. As advised by LNAC, Santos organised two consultation sessions to be held in Darwin on 19 December 2023. The sessions were advertised in the NT News and held during the day and at a location outside the city centre (Nightcliff Community Centre), as suggested by LNAC.

A further consultation session on DPD activities was advertised in Darwin and held on 12 June 2024. Advertising (refer Table 4-6) included geo-targeting on social media as well as direct phone calls to Larrakia people known to Santos, as Santos has found these methods to be the most effective to reach Larrakia people.

Santos' ongoing engagement with First Nations people and organisations included two dedicated sessions for Larrakia People on the Barossa Project which included discussion of DPD activities and an opportunity to ask questions of Santos subject matter experts. These sessions were held in Darwin on 23 April 2024 and achieved good attendance.

While not tailored specifically to Larrakia people, other opportunities for Larrakia people in the Darwin area to engage on the DPD Project, and the broader Barossa Project, were made available through community drop-in sessions throughout 2023, which were broadly advertised to the Darwin community through radio and local newspapers.

Drop-in sessions are usually timed to occur on dates coinciding with consultation periods for EPs and held at easily accessible locations in the Darwin CBD. At the sessions Santos representatives are available to answer questions and receive feedback on activities including those that are the subject of the current EP consultation. Information booklets are provided and project maps and i-Pads pre-loaded with video content used as information tools.

Santos notes that further information about Larrakia cultural values and sensitivities was obtained outside the OPGGS(E)R section 25 consultation process via the study into cultural and spiritual values in the DPD Project footprint conducted by Dr Corrigan, an independent anthropologist, which is discussed in Section 3.2.14.

4.5.4.3 Consultation with Tiwi Islands clans and individuals

As a result of specific requests and feedback expressed by Tiwi people as to the consultation process and consultation preferences, Santos implemented the following tailored consultation approach for Tiwi people:

- Consultation activities were conducted face-to-face in the form of clan meetings on the Tiwi Islands on the following dates: 5–7 December 2023; 30–31 January 2024, 1–2 February 2024, 5–7 March 2024, 8 and 17 May 2024.
- Clan meetings were arranged for each clan at a location convenient for that clan (members of other clans attended with clan trustee consent).
- Clan meetings were scheduled with approximately 4 weeks' prior written notice (see Table 4-6).
- Use of visual aids, videos and animations in presenting information (including information of a more technical nature) to improve accessibility and comprehension.

- Santos representatives and subject matter experts explained the activity, risks and impacts during in person presentations, assisted by video content, and PowerPoint slides and responded to questions.

For each consultation session, Santos developed short videos explaining the purpose of the session and key information relating to the consultation process, how feedback could be provided, privacy obligations and non-publication requests. Parts of these videos were recorded by a local Tiwi man in Tiwi language.

After each consultation session, Santos representatives and subject matter experts were available to answer additional questions or provide further information to clan members and individuals. This offered people the opportunity to speak to Santos representatives or subject matter experts one-on-one or in a smaller group setting (based on feedback this was a more comfortable format for some people).

An independent, qualified interpreter assisted Santos at sessions to provide translation as required. Santos also used local interpreters where qualified interpreters were not available through the Aboriginal Interpreter Service. Santos' observation at clan group meetings was that many Tiwi people spoke and understood English, and this was noted by members of the Tiwi Island community themselves.

Written consultation materials tailored for Tiwi Islands clan groups and individuals were produced and distributed or made available at consultation sessions, including a fact sheet and maps.

A FAQ document in response to questions posed by Tiwi Islands clan groups and individuals was prepared and distributed or made available at the consultation sessions.

Santos provided information about NOPSEMA's brochure on consultation on offshore petroleum environment plans and distributed the brochure at consultation sessions.

On occasions Santos assisted in organising transport for clan members who were having difficulty attending the consultation sessions due to road closures.

On occasions Santos rescheduled consultation sessions to accommodate 'Sorry Business' on the Islands.

In addition to the sessions held on the Tiwi Islands, sessions were also held in Darwin, one for Tiwi Islands people with interests in the Vernon Islands and the other for any Darwin-based Tiwi People.

Consultation sessions for Tiwi people were notified and advertised as set out in Table 4-6.

Table 4-6 includes a chronology of consultation with Tiwi Islands clans.

Table 4-6: Notification and Advertising of Tiwi and Larrakia Consultation Sessions

Date	Advertising type	Description	Reach
For Tiwi December 2023 sessions			
13 November 2023	Press ad – NT News	Half page, page 6	Target NT with reach of 25,000
14 November to 8 December 2023	Social media ad	Facebook,	Geotargeted Darwin, Tiwi Islands and NT
14 November and 7 December 2023	Social media Notice	Tiwi Notice Board Facebook Page	Geotargeted Tiwi Islands – 2,800 members
For Larrakia December 2023 sessions			
19 December 2023	Press ad – NT News	Full page, page 12	Target NT with reach of 25,000
18, 19 December 2023	Social media ad	Facebook	Geo-targeted Darwin and surrounding areas (e.g. Burrundie and Kakadu, Tiwi Islands and NT
For Tiwi January/February 2024 sessions			
January 2024	Social media notice	Facebook, Tiwi Notice Board Facebook Page	Geotargeted Tiwi Islands – 2,800 members
22 January 2024	Press ad – NT News	Full page, page 6	Target NT with reach of 25,000

Date	Advertising type	Description	Reach
19 February 2024	Press ad – NT News	Full page, page 19	Target NT with reach of 25,000
26 February	Press ad – NT News	Full page, page 11	Target NT with reach of 25,000
For Tiwi March/April 2024 sessions			
February/March 2024	Social media Notice	Facebook, Tiwi Notice Board Facebook Page	Geotargeted Tiwi Islands – 2,800 members
4 March 2024	Press ad – NT News	Full page, page 6	Target NT with reach of 25,000
26 March 2024	Press ad – NT News	Full page, page 6	Target NT with reach of 25,000
2 April 2024	Press ad – NT News	Full page, page 6	Target NT with reach of 25,000
6 April 2024	Press ad – NT News	Full page, page 12	Target NT with reach of 25,000
For Tiwi May 2024 sessions			
April / May 2024	Social media Notice	Facebook, Tiwi Notice Board Facebook Page	Geotargeted Tiwi Islands – 2,800 members
8 May 2024	Press Ad NT News	Full page, page 8	Targeted NT with reach of 25,000
15 May 2024	Press Ad NT News	Full page, page 6	Targeted NT with reach of 25,000
20 May 2024	Press Ad NT News	Full page, page 6	Targeted NT with reach of 25,000
For Larrakia June 2024 sessions			
1 June 2024	Press ad – NT News	Full page, page 30	Target NT with reach of 25,000
5 June 2024	Press ad – NT News	Full page, page 8	Target NT with reach of 25,000
8 June 2024	Press ad – NT News	Full page, page 21	Target NT with reach of 25,000
7-12 June 2024	Social media ad	Facebook, Instagram, Messenger	Geo-targeted Darwin and surrounding areas (e.g. Burrundie and Kakadu, Tiwi Islands and NT)

4.5.5 First Nations Consultative Committees

Santos notes that there are remote areas of coastal Northern Australia where formal mechanisms for consultation are few or non-existent.

To support consultation in these areas for this EP, Santos engaged a consultant to support the establishment of First Nations Consultative Committees (FNCCs) with the intention that these be self-nominating and self-governing, and independent of government or industry. The intended purpose of these committees is to provide a forum to allow for culturally appropriate consultation with the First Nations peoples represented by the FNCCs, and to serve as a means for those peoples to provide feedback to third parties on matters on which the FNCC is consulted.

The FNCC establishment process is led by cultural advisors, comprising a team of First Nations leaders with extensive knowledge and experience in relation to First Nations cultures of Northern Australia, and who possess deep cultural connections to the First Nations peoples of this region.

The FNCC establishment process commences with the identification by the cultural advisers of First Nations clans and associated persons who may have functions, interests or activities that may be affected by activities Santos proposes to carry out under an environment plan.

The cultural advisors then contact the identified First Nations persons to discuss the FNCC concept. Santos understands that this includes meetings with Elders and other First Nations leaders who speak for coastal and sea country that may be affected by project activities. Where an interest to participate in the FNCC process is expressed, the cultural advisers support the relevant clan group to establish their own FNCC and to self-determine its functions and operations, including in relation to committee membership, leadership and governance arrangements and desired level and method of consultation.

This process involves the cultural advisors sharing knowledge and experience in relation to their participation on established committees and supporting the identified clan members to determine their own rules and processes for committee decision-making, membership and the nomination of chairs. Once determined, these matters are formally documented in charters adopted by the FNCCs. Santos has been provided with a copy of the charters of the FNCCs that it consulted for this EP, which include details about the FNCCs' purposes, membership and procedures.

Once established, and subject to the wishes of FNCC members, the external cultural advisors may provide ongoing support to the FNCCs, including administrative and advisory services. Santos engaged a consultant to support FNCC establishment and operations. This consultant maintains regular contact with FNCCs and Clan groups to facilitate Santos' consultation with these groups.

For the consultation sessions with these groups, similar to the Tiwi Clan Group sessions (described in Section 4.5.4.3), visual aids, videos and animations were used to present information (including information of a more technical nature) to improve accessibility and comprehension. Santos' representatives and subject matter experts explained the activity, risks and impacts during in person presentations, assisted by video content, and PowerPoint slides and responded to questions.

The activities of these committees are complementary to the functions and responsibilities of representative organisations, such as Land Councils or other formal bodies, with the intention that they be in a position to represent First Nations peoples.

For this EP, FNCC interests are outlined in Table 4-7.

4.5.5.1 Consultation with other clans

In some instances, Santos consulted individual clan groups with NT coastal interests, where FNCCs or other representative bodies are not established. For this EP, Santos consulted members of the Agalda clan and the Wulna clan. Clan interests are outlined in Table 4-7.

4.5.6 Relevant Persons

A list of potentially Relevant Persons was developed through application of the above methodology for the purposes of undertaking preliminary consultation to confirm consultation expectations.

This consultation phase was supported by an advertising campaigned outlined in Table 4-9 to raise public awareness about the proposed DPD Project, including the DPD activities for this EP, and provide opportunities for authorities, persons or organisations to identify themselves as Relevant Persons. For this EP, no authorities, persons or organisations self-nominated as Relevant Persons.

Relevant Persons consulted for this EP are listed in Table 4-7.

Table 4-7: Summary of Relevant Persons

Relevant Person Category	Summary of Relevance
Section 25(1)(a) of the OPGGS(E)R: Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant	
Australian Communications and Media Authority (ACMA)	ACMA is responsible for the regulation of communications and media services in Australia. ACMA is a relevant agency because the Activity has the potential to impact future proposed subsea communications cable installations.
Australian Fisheries Management Authority (AFMA)	AFMA is responsible for managing Commonwealth fisheries and is a relevant agency because the Activity has the potential to impact on fisheries resources in AFMA managed fisheries. AFMA expects petroleum operators to consult directly with fishing operators about all activities and projects which may affect day to day fishing activities. AFMA also provides industry association contacts for petroleum operators to use when consultation with fishing operators is required.
Australian Hydrographic Office (AHO)	AHO is responsible for maintaining and disseminating nautical charts, including the distribution of Notices to Mariners.
Australian Institute of Marine Science (AIMS)	AIMS is Australia's tropical marine research agency and is established under the *Australian Institute of Marine Science Act 1972* (AIMS Act).
Australian Maritime Safety Authority (AMSA) – maritime safety	AMSA is the statutory and control agency for maritime safety and vessel emergencies in Commonwealth Waters. AMSA is a relevant agency because the proposed offshore activities may impact on the safe navigation of commercial shipping in Australian waters.
Australian Maritime Safety Authority (AMSA) – marine pollution	AMSA is the statutory and control agency for maritime safety and vessel emergencies in Commonwealth Waters. AMSA is a relevant agency as one of its functions is to prevent and combat ship-sourced pollution in the marine environment.
Department of Agriculture, Forestry and Fisheries (DAFF) – Biosecurity	DAFF administers the *Biosecurity Act 2015* (Cth) which is designed to contain and/or deal with diseases and pests that may cause harm to human, animal or plant health or the environment in Australia. DAFF is a relevant agency for consultation because the Activity involves the movement of vessels into Australia territory and between Australian ports and offshore petroleum facilities.
Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries	DAFF also has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. DAFF is a relevant agency for consultation because the Activity has the potential to impact on fishing operations and/or fishing habitats in Commonwealth waters.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) – Underwater Cultural Heritage	DCCEEW protects Australia's natural environment and heritage sites, helps Australia respond to climate change and carefully manages water and energy resources. The Underwater Cultural Heritage branch at DCCEEW is responsible for administering the UCH Act. It is a relevant agency where an activity has the potential to directly or indirectly adversely impact protected UCH.
Department of Defence (DoD)	DoD is a relevant agency for consultation because: • the proposed Activity may impact DoD training and operational requirements, in that the EMBA overlaps DoD training areas. • the proposed Activity encroaches on known training areas and/or restricted airspace. • there is a risk of unexploded ordnance in the area where the Activity is taking place.
Department of Home Affairs and Australian Border Force (ABF)	The Department of Home Affairs is responsible for overseeing migration, national security and resilience, and border-related functions. ABF is an operationally independent body within the Home Affairs portfolio. ABF is Australia's border law enforcement agency and customs service. ABF's vessels undertake patrols as part of its surveillance and response activities throughout an offshore maritime area of almost 45.1 million km^2. This area includes the EMBA.

Relevant Person Category	Summary of Relevance
Department of Industry, Science and Resources (DISR)	DISR is a relevant agency for consultation because its responsibilities include offshore oil and gas development and safety and GHG storage.
Director of National Parks (DNP)	DNP is the statutory authority responsible for administration, management and control of Commonwealth marine reserves. The DNP is a Relevant Person for consultation where: • the Activity or part of the Activity is within the boundaries of a proclaimed Australian Marine Park; • activities proposed to occur outside a reserve may impact on the values within a Australian Marine Park; and / or • an environmental incident occurs in Commonwealth waters surrounding a Australian Marine Park and may impact on the values within the Australian Marine Park.
Fisheries Research Development Council (FRDC)	FRDC has a formal role in the planning and investment in fisheries research and development to support the ongoing sustainability of aquatic sectors and aquatic ecosystems. It is a co-funded partnership between the Australian Government and fisheries and aquaculture and a statutory corporation under the *Primary Industries Research and Development Act 1989* (Cth) responsible to the Minister for Agriculture, Fisheries and Forestry.
Indigenous Land and Sea Corporation (ILSC)	ILSC is a corporate Commonwealth entity established under the *Aboriginal and Torres Strait Islander Act 2005* (Cth). The ILSC provides assistance for acquiring and managing rights and interests in land, salt water and freshwater country. The ILSC in Darwin works closely with the Northern Land Council. The EMBA enters NT Waters.
National Indigenous Australians Agency (NIAA)	NIAA is an Australian Government agency responsible for whole-of-government coordination of policy development, program design and service delivery for Indigenous Australians.
Section 25(1)(b) of the OPGGS(E)R: Departments or agencies of the Northern Territory to which the activities to be carried out under the environment plan may be relevant.	
Aboriginal Areas Protection Authority (AAPA)	The AAPA supports development while safeguarding Aboriginal sacred sites. Under the NTASS Act, the AAPA is responsible for overseeing the protection of Aboriginal sacred sites on land and sea across the whole of the NT. The NTASS Act also gives the Authority the power to prosecute people and organisations that damage sacred sites.
Department of Environment, Parks and Water Security (NT) (DEPWS)	DEPWS combines the functions of the previous Department of Environment and Natural Resources and the Parks and Wildlife Commission from the former Department of Tourism, Sport and Culture (DTSC). The government established the department to combine many of the key functions that foster and protect the environment and natural resources in the NT. This includes water, land resource management, environmental issues and the parks and wildlife functions.
Department of Industry, Tourism and Trade (NT) – Fisheries Division	DITT-NT – Fisheries has functions in relation to NT-managed fisheries. The OA overlaps NT-managed fisheries. The Aquatic Biosecurity Unit of Northern Territory Fisheries monitors and manages the risk of new marine pests arriving in the NT. The unit monitors for early detection of aquatic pests; coordinates inspections and treatment of high-risk vessels entering Darwin; responds to reported sightings of invasive freshwater and marine pests; and educates the public about the impacts, prevention and management of aquatic pests. The Department also operates the Darwin Aquaculture Centre, the NT Government's key aquaculture research and development facility.
Department of Infrastructure, Planning and Logistics (NT) – Transport	DIPL-NT-Transport is responsible for all aspects of marine transport in NT waters, including the Port of Darwin which will continue to be the supply base for Barossa offshore activities.
Department of Territory Families, Housing and Communities (NT) – Heritage branch (DTFHC-NT-Heritage)	The DTFHC-NT-Heritage has a role in protecting the maritime heritage of the NT.

Relevant Person Category	Summary of Relevance
NT Department of Police, Fire and Emergency Services	The Department would be involved in response measures in the event of a spill in NT Waters.
Parks and Wildlife Commission of the Northern Territory	Parks and Wildlife Commission of the Northern Territory is the NT Government agency responsible for tasks including the establishment, management and protection of parks, reserves, sanctuaries and other land, and the protection, conservation and sustainable use of wildlife.
Power and Water Corporation (NT)	Power and Water Corporation is a government-owned corporation responsible for the transmission and distribution of electricity and provision of water and sewerage services across the NT.
Tourism NT	Tourism NT is the government statutory authority responsible for promoting tourism in the NT, including potential activity by NT-based operators in the EMBA.
Section 25(1)(b) of the OPGGS(E)R: Departments or agencies of Western Australia to which the activities to be carried out under the environment plan may be relevant.	
Department of Primary Industries and Regional Development (DPIRD-WA) – Fisheries	DPIRD-WA is responsible for managing West Australian fisheries. Several WA-managed commercial fisheries which extend beyond WA Waters and into Commonwealth Waters of the EMBA.
Department of Transport (DoT)	DoT has functions in relation to commercial vessel movements in the navigable waters of the State and seas adjacent to WA. Its interests extend to response to an unplanned spill event through its Maritime Environmental Emergency Response unit.
Section 25(1)(c) of the OPGGS(E)R: Department of the responsible Northern Territory Minister.	
NT Department of Industry, Tourism and Trade (DITT-NT) – Energy Division	DITT-NT is the department of the responsible Territory Minister and is required to be consulted under regulation 25(1)(c) of the OPGGS(E)R.
Section 25(1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan	
Academic and Research Organisations	
Arafura Timor Research Facility (ATRF)	ATRF is a joint venture between AIMS and the Australian National University. It was developed through a successful Major National Research Facilities grant application with support from the NT government and Charles Darwin University. The facility was established to accommodate world class research into marine and coastal ecosystems of the Arafura and Timor seas and to explore the increasing threats to Australia's fisheries and marine biodiversity in the region. A wide range of research activities are being processed.
Australian Marine Sciences Association – NT (AMSA-NT)	AMSA-NT is a professional body for marine scientists, with a branch in the NT. Its listed interests and stated activities include promoting all aspects of marine science in the NT and making formal comment on NT marine development assessments and NT Government policies, strategies and plans, and nominations of rare and threatened marine species and habitats in the NT.
AusTurtle Inc	AusTurtle Inc. is a non-profit organisation that promotes sea turtle conservation and research in northern Australia.
Charles Darwin University	The NT's main university is research-intensive with a range of projects and partnerships in indigenous and tropical health, environmental science and public policy. One example is the current investigation of low technology, sea-based aquaculture systems for remote coastal communities. The team is sampling wild blacklip oysters from 8 locations across the NT, assessing shellfish quality, heavy metals and vibrio testing. CDU is a member of the Darwin Harbour Advisory Committee
Darwin Harbour Advisory Committee	The Darwin Harbour Advisory Committee provides advice to the NT Government through the Minister for Environment, Parks and Water Security on the effective management of Darwin Harbour and its catchment.

Relevant Person Category	Summary of Relevance
Commercial fishing – Commonwealth managed	
Commonwealth-managed fisheries that overlap the EMBA (based on AFMA guidance): • Northern Prawn Fishery • Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery • North-West Slope Trawl Fishery	Licence holders of these fisheries are entitled to fish within the EMBA and consulted based on published AFMA guidance.
Commercial fishing – Northern Territory managed	
NT-managed fisheries that overlap the EMBA: • Aquarium Fishery • Bait Net Fishery • Barramundi Fishery • Coastal Line Fishery • Coastal Net Fishery • Demersal Fishery • Development (Small Pelagic) • Mud Crab Fishery • Offshore Net and Line Fishery • Pearl Oyster Fishery • Spanish Mackerel Fishery • Timor Reef Fishery • Trepang Fishery.	Licence holders of these fisheries are entitled to fish within the EMBA and consulted based on published AFMA guidance.
Commercial fishing – Western Australian managed	
Licence holders in the following WA-managed fisheries: • Abalone • Kimberley Crab Fishery • Mackerel Managed Fishery • Marine Aquarium Fishery • Northern Demersal Scalefish Managed Fishery	Licence holders of these fisheries are entitled to fish within the EMBA and consulted based on published AFMA guidance.

Relevant Person Category	Summary of Relevance
• South-West Costal Salmon Fishery • Specimen Shell Fishery • West Coast Deep Sea Crustacean Fishery	
Energy Industry – Petroleum titleholders and GHG permit holders	
Operators: • Eni Australia Ltd • INPEX Ichthys Pty Ltd • Woodside Energy Ltd • Melbana Energy Pty Ltd • MEO • Neptune Energy • Shell Development (Australia) Pty Ltd	Operators within the EMBA.
Environmental conservation organisations	
Australian Marine Conservation Society – NT (AMCS-NT)	According to its website[35]: • AMCS-NT is a grassroots independent environmental conservation organisation and charity that works to protect ocean wildlife along the NT coastline, waters and seas. • Its members work to protect marine animals and critical ocean ecosystems. • It advocates for evidence-based solutions to conservation activity and works closely with marine research centres. • Its interests for the purposes of this EP relate to marine parks and sanctuary zones within the EMBA for threatened and at-risk species.
Conservation Council of WA (CCWA)	According to its website and correspondence dated June 2024, CCWA[36] promotes an interest in the protection and restoration of the WA natural environment.
Environment Centre Northern Territory (ECNT)	According to its website, ECNT[37] is a not-for-profit incorporated association whose objects include protection of all aspects of the natural environment, conducting campaigns to protect the natural environment, environmental research, and public education and information about the natural environment. ECNT is involved in the “Stop Barossa Gas” campaign.

[35] *https://www.marineconservation.org.au/northern-territory-marine-parks/*
[36] *https://www.ccwa.org.au/about*
[37] *https://www.ecnt.org.au/campaigns*

Relevant Person Category	Summary of Relevance
Greenpeace	According to its website, Greenpeace's stated goals include the protection of ocean biodiversity and marine life, including campaigning for protection of whales[38] (fauna identified in this EP as potentially affected by the Activity impacts or risks) and sea turtles[39] (also fauna identified in this EP as potentially affected by the Activity impacts or risks).
Keep Top End Coasts Healthy	According to its website, Keep Top End Coasts Healthy[40] is an alliance of environment groups including the AMCS and the ECNT. In information provided by Keep Top End Coasts Healthy to Santos via Santos' website portal during consultation for the D&C EP, Keep Top End Coasts Healthy claims to work with stakeholders with respect to coastal preservation and establishment of marine protected areas, potentially including within the EMBA. Further, 2 members of the alliance, AMCS and ECNT, are included as Relevant Persons in this EP.
Landcare NT (member of Darwin Harbour Advisory Committee)	This organisation's function and activities includes protection of areas along the NT coastline and water quality. It is also a member of the Darwin Harbour Advisory Committee.
Sea Turtle Foundation	According to its website, the Sea Turtle Foundation[41] is a non-profit, non-government group based in Australia with a stated interest in protecting sea turtles through research, education and action, including specifically the olive ridley turtle, leatherback turtle, loggerhead turtle and flatback turtle, being turtle species cited in this EP as being potentially affected by the impacts or risks of the Activity.
Territory Natural Resource Management (member of Darwin Harbour Advisory Committee)	This organisation's function and activities includes protection of areas along the NT coastline and water quality. It is also a member of the Darwin Harbour Advisory Committee and is consulted via its member on the DHAC.
The Wilderness Society (TWS)	According to its website, TWS is a peak conservation body with an interest in activities that may affect the marine environment.
World Wildlife Fund (WWF)	WWF is a peak conservation body with an interest in activities that may affect the marine environment.
First Nations People and groups	
The following groups may have interests that intersect the EMBA. Information was also provided to these organisations to help identify and consult groups or individuals whose spiritual or cultural connections to land and sea country in accordance with Indigenous tradition may be affected by proposed activities. In addition, targeted regional advertising was conducted to provide opportunity for individuals whose functions, interests and activities may be affected by the proposed activity to self-identify as Relevant Persons.	
Representative organisations – NT	
Northern Land Council (NLC)	NLC is the Native Title Representative Body for the Northern Region, including sea country. Its functions are prescribed under the NT Act. NLC also has statutory obligations under the ALR Act and is authorised to perform certain functions under the NT Act including responsibility for administering and directing the functions and actions of Aboriginal Land Trusts. NLC's area of interest includes sea country where non-exclusive native title rights and interests may exist, including within the EMBA. NLC Executive Council members are also the directors of the Top End (Default PBC/CLA) Aboriginal Corporation RNTBC (TED PBC) which is responsible for an area of sea country near the Croker Islands. The NLC also provides administrative services to the Corporation.

[38] *https://www.greenpeace.org.au/what-we-do/protecting-oceans/whales/*

[39] *https://www.greenpeace.org/international/story/28229/turtle-journey-urgent-protect-the-oceans/; https://www.greenpeace.org/international/publication/28181/turtles-under-threat/*

[40] *https://www.topendcoasts.org.au/*

[41] *https://seaturtlefoundation.org/about*

Relevant Person Category	Summary of Relevance
Tiwi Land Council (TLC)	The TLC is governed under the ALR Act. The Tiwi ABT was also established under the ALR Act and the TLC is the only body with authority to direct the Trust. The authority of the TLC does not extend into Commonwealth offshore waters, although the sea country interests of Tiwi Island clans do, including within the EMBA.
Wickham Point Deed liaison committee	The objective of the Wickham Point Deed liaison committee is to strengthen the dialogue between Santos and the Larrakia people and support the delivery of the parties' commitments under the Wickham Point Deed entered into between Darwin LNG and the Northern Land Council on 29 April 1999. Santos coordinates quarterly meetings with the Wickham Point Deed liaison committee, which includes representatives from Larrakia family groups, the functions of which are set out in the Wickham Point Deed and include making recommendations to Santos on various matters such as environmental, cultural heritage, employment and business opportunities.
First Nations Consultative Committees and coastal clan groups – NT	
Agalda clan	The Agalda clan estate is located over the western parts of the Cobourg Peninsula, including coastal areas and adjacent sea country.
Daly River / Port Keats FNCC	Represents the coastal clan groups of the Daly River / Port Keats ALT and adjacent sea country. These clans are understood to include the Yek Yedere, Rak Kinmu, Yek Nangu, Yek Maninh, Kura Thipma and Kuy clans, whose estates are located in this area. The FNCC was formed with the objective of enabling culturally appropriate consultation with First Nations clan groups represented on the FNCC, so they can provide feedback to third parties on matters that the FNCC wishes to be consulted about.
Mulyurrud Consultative Committee	Represents First Nations peoples of Croker Island, including the traditional owners and custodians of Croker Island and surrounding sea country. It is understood that the Committee represents the Mangalarra and Mandilarri clan estates located on Croker Island and adjacent sea country, and the Ildugidj clan estate located on the mainland coastline (south from Croker Island). The FNCC was formed with the objective of enabling culturally appropriate consultation with the First Nations clan groups represented on the FNCC, so they can provide feedback to third parties on matters that the FNCC wishes to be consulted about.
Rak Badjalarr Consultative Committee	Represents the Kenbi, Emmiyangal, Mendheyangal, Kiyuk, Wadigany, Murranungu, Malak Malak and Marriamu clans which are all part of the Belyuen or Wagait communities. The named clan estates are located over the coastal areas from the Cox Peninsula south to the area of the Daly River and adjacent sea country, including Peron Islands and Channel Point. The FNCC was formed with the objective of enabling culturally appropriate consultation with these First Nations clan groups, so they can provide feedback to third parties on matters that the FNCC wishes to be consulted about.
Tiwi Islands Clan Groups and Individuals	The Appeal Judgment found that "Mr Tipakalippa and the Munupi clan had interests within the meaning of reg 11(A)(d)[42] of the OPGGS(E)R that required them to be consulted[43]. Mr Tipakalippa had claimed that he and the Munupi clan, as well as other Tiwi Island people, have "sea country" in the Timor Sea to the north of the Tiwi Islands. The Tiwi Islands are located approximately 80 km north of Darwin in the Arafura Sea. There are 3 major communities on the Tiwi Islands. The largest community is Wurrumiyanga (on Bathurst Island), with smaller communities of Milikapiti and Pirlangimpi located on Melville Island. There are 8 landowning groups (clans) on the islands, Mantiyupwi, Munupi, Yimpinari, Malawu, Wulirankuwu, Wurankuwu, Mirrikawuyanga and Jikilaruwu (or Tikalaru). Members of the Mantiyupwi clan also speak for the Vernon Islands, which are located between the Tiwi Islands and mainland NT.
Wulna clan	The Wulna clan estate is located on coastal areas and adjacent sea country from the Gunn Point area in the west and extending east from the Adelaide River. Members of the Wulna clan are Party to the Mary River ILUA.

[42] *Section 25(1)(d) of updated OPGGS(E)R 2023*

[43] *Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 [80]*

Relevant Person Category	Summary of Relevance
Larrakia people	The Larrakia people are the traditional owners of the Darwin region. Larrakia country runs from Cox Peninsula in the west to Gunn Point in the north, Adelaide River in the east and down to the Manton Dam area southwards.
Other First Nations organisations – NT	
Aboriginal Sea Company	Incorporated entity with administrative support provided by the NLC. The Aboriginal Sea Company's area of interest is the entire Top End (sea country and intertidal). The Company facilitates the participation of Traditional Owners in commercial fishing, aquaculture and other opportunities associated with fishing activities in NT waters that could be impacted by planned activities or an unplanned spill. The Company is governed by a board comprising representation from the 3 land councils with traditional ownership of sea country – Northern, Tiwi and Anindilyakwa land councils.
Gwalwa Daraniki Association	Place / Area of Interest (descriptions of land includes adjacent sea country): Kalaluk and Minmarama Communities in Darwin.
Kenbi Rangers	Place / Area of Interest (descriptions of land includes adjacent sea country): Cox Peninsula - Darwin and Bynoe Harbours and Islands. Kenbi Rangers' base on Cox Peninsula is administered by the NLC.
Larrakia Development Corporation	Seeks to create economic opportunity for Larrakia People through leading land development activity and advocating for Larrakia People's interests. Represents 9 Larrakia family groups. Place / Area of Interest (descriptions of land includes adjacent sea country): Darwin and surrounds.
Larrakia Nation Aboriginal Corporation	Larrakia Nation is one of Darwin's leading community service organisations. Larrakia Nation Aboriginal Corporation was set up in 1997 through the NLC to provide a corporate identity for Larrakia people to uphold Native Title claims. In 20 years, it has grown to represent the Traditional Owners of the Darwin region and to speak on behalf of Larrakia people while delivering community and outreach services to the broader Darwin community. Larrakia Nation also operates the Larrakia Land and Sea Ranger services.
North Australian Indigenous Land and Sea Management Alliance	Darwin-based Native Title Prescribed Body Corporate with administrative services via the NLC. NLC Executive Council members are the directors of the Top End Default Prescribed Body Corporate. Place / Area of Interest (descriptions of land includes adjacent sea country): Entire Top End.
Representative Organisation – WA	
Kimberley Land Council (KLC)	KLC is the Native Title Representative Body for the Kimberley region in WA. Its primary role is to provide native title services to Kimberley Aboriginal people. KLC's area of interest includes sea country where non-exclusive native title rights and interests may exist, including within a section of Commonwealth waters within the EMBA.
Industry Associations – commercial fishing	
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA represents the interests of commercial fishers in the Southern Bluefin Tuna Fishery and Western Skipjack Fishery.
Commonwealth Fisheries Association (CFA)	CFA represents the interests of commercial fishers with licences in Commonwealth waters.
Northern Prawn Fishery Industry (NPFI)	NPFI represents the interests of the interests of commercial fishers in the Northern Prawn Fishery.
Northern Territory Seafood Council (NTSC)	NTSC is the peak representative body for the wild catch, aquaculture and trader/processor seafood sectors in the NT.
Western Australian Fishing Industry Council (WAFIC)	WAFIC represents the interests of the WA commercial fishing, pearling and aquaculture sector.
Industry Associations – recreational fishing	

Relevant Person Category	Summary of Relevance
Amateur Fishermen's Association of the Northern Territory (AFANT)	AFANT is the peak body representing NT recreational fishers whose interests may intersect the EMBA.
Industry Associations – tourism	
Northern Territory Guided Fishing Industry Association (NTGFIA)	NTGFIA is the peak body responsible for promoting, developing, and maintaining the guided fishing industry in the NT. It represents professional fishing guides and operators. Interests may intersect the EMBA.
Tourism Top End	Tourism Top End is the Regional Tourism Association, a non-profit entity serving businesses, individuals and organisations involved in tourism activities in the NT. Interests may intersect the EMBA.
Industry Associations – local industry	
Chamber of Commerce Northern Territory	Regional representative organisation representing the interests of local business.
Infrastructure operators	
BW Digital	BW Digital is privately-owned, carrier-neutral and innovative to deliver optimal customer service. It develops, builds and operates a digital ecosystem, specialising in data transport, compute and storage to connect countries across oceans sustainably.
Darwin Port	Private consortium responsible for the management of shipping and other commercial activities requiring use of Darwin Harbour. Santos-contracted vessels plan to use Darwin Harbour.
NT Port and Marine	Private consortium that owns and operates the commercial port at Port Melville on the Tiwi Islands.
Sun Cable	Privately-owned consortium with plans to install new submarine cable infrastructure in NT and Commonwealth waters in the EMBA.
Telstra	Telstra Group Limited is an Australian telecommunications company that builds and operates telecommunications networks and markets related products and services.
Vocus	Operator of the following infrastructure, which is in the EMBA: Darwin-Jakarta-Singapore Cable (DJSC) and North West Cable System (NWCS).
Local Government Authorities – NT	
City Of Palmerston Council	The City of Palmerston is a local government area of the NT. It contains the suburbs of Darwin's satellite city, Palmerston, and is situated between the outer industrial areas of Darwin and the rural areas of Howard Springs.
City of Darwin	The City of Darwin is a local government area of the NT. It includes the central business district of the capital, Darwin City, and represents two-thirds of its metropolitan population. Located on the traditional land and waterways of the Larrakia people.
Litchfield Council	Responsible for local community representation on a range of issues, potentially including environmental protection. The Council's area includes NT coastline.
Wagait Shire Council	The Wagait Shire is a local government area in the NT. It is located west of Darwin, as a 15-minute ferry ride, or a 138 km drive on fully sealed roads.
Tourism Operators – NT	
Darwin and Tiwi Islands-based operators	Marine tourism operators active within the EMBA.

4.5.7 Consultation design

Santos designed and implemented its consultation process, acknowledging that the consultation process may need to be adapted to the nature of the person or organisation to be consulted.

To assist in designing an appropriate consultation process, Santos sought feedback about consultation methods and information needs in its correspondence and via a portal and form available on its website. Santos also sought information as to functions, interests or activities that may be affected by the Activity.

Santos offered and provided information in different formats and via a range of different mediums both at the request of Relevant Persons and of its own volition, having regard to the nature of particular Relevant Persons and their potentially affected functions, interests or activities.

Section 4.5.8 outlines Santos' provision of sufficient information. Preferences expressed by Relevant Persons regarding design of the consultation process were considered and accommodated by Santos, where reasonably practicable and appropriate.

Santos also adopted a tailored approach to consultation with Tiwi Islands clans and individuals, other coastal First Nations communities and Consultative Committees in respect of consultation session structure and format, and consultation materials, based on their specific requests and feedback.

4.5.8 Provision of sufficient information

Santos provided Relevant Persons with sufficient information so they can make an informed assessment about the possible consequences of the Activity on their functions, interests or activities. Santos provided Relevant Persons with information regarding:

- The Activity proposed under this EP;
- The environment that may be affected by the Activity, including depictions of the modelled EMBA and explaining how the EMBA is determined;
- The potential environmental impacts and risks of the Activity and proposed control measures;
- The environmental approval process;
- The purpose of consultation, who may be a Relevant Person and how to self-nominate as a potential Relevant Person;
- The titleholder's obligations during consultation in the course of preparing an environment plan, including the obligation of the titleholder not to publish particular information if so requested by the Relevant Person; and
- How to provide feedback.

Relevant Persons were provided access to information using different mediums and platforms, including by telephone, email, website (https://www.santos.com/barossa/), hard copy and electronic materials, social media, in person and virtual meetings.

At a minimum, this information was available on the Santos website and also included in the fact sheets which Santos sent to Relevant Persons by email or made available during consultation sessions.

Santos also developed targeted consultation material appropriate to Relevant Persons, including visual aids and videos for First Nations groups and for Tiwi people (discussed above).

Examples of the consultation materials used are included in Appendix E and included the following:

- Information booklet
- Consultation fact sheets:
- A FAQ document, responding to queries and feedback during consultation with Tiwi People provided as part of the consultation process.
- For particular Relevant Persons or particular groups of Relevant Persons, videos, animations and maps to convey technical information to different audiences in a clear and accessible way.

Santos also disseminated and promoted the NOPSEMA community information brochure, *Consultation on offshore petroleum environment plans*. This brochure contains information for community members to better understand the responsibilities of titleholders to consult Relevant Persons in the development of environment plans, the purpose of consultation and how Relevant Persons can provide feedback.

4.5.9 Consultation approach

In developing this EP Santos has sought to work with authorities, persons and organisations on pragmatic and practical approaches to section 25 consultation.

Santos sought feedback about consultation methods and information needs in its correspondence and via consultation meetings. Santos also sought information as to functions, interests or activities that may be affected by the activity.

This approach has included:

- Providing Relevant Persons access to information using different mediums and platforms, including by telephone, email, website, electronic materials, in person and virtual meetings.
- Making information about the proposed activities to be managed under this EP available on the Santos website at www.santos.com/offshoreconsultation. Provision of hyperlinks to this website were included in consultation emails.
- Recognising NTSC's feedback that information should be provided via post direct to relevant licence holders in addition to being provided to the NTSC which consults directly with the chairs of each fishery.
- Recognising NPFI's feedback that it will pass along any information to its members where required and relevant, acknowledging NPFI has advised there is no need for Santos to directly engage with its members.
- Recognising WAFIC's published guidance that petroleum titleholders consult directly with those Western Australian fishery licence holders that have been historically active in Operational Areas, while providing a list of all entitled fisheries that overlap the EMBA. This approach acknowledges previous feedback from WAFIC regarding consultation fatigue among WA's estimated 1500 fishing boat licence holders.
- Application of this activity-centric approach has been applied to consultation with respect to commercial and recreational fishing, given the significant geographic extent of some of commercial fisheries and the location of historical catch and effort by commercial and recreational fishers relative to the proposed petroleum activity. This approach considers:
    - Advice from a representative organisation, the NPFI, that it will pass along any information to its members where it is required and relevant.
    - Using a WAFIC fee-for-service arrangement to circulate Santos' consultation information via email to licence holders and making information available to potentially affected commercial fishing licence holders.
    - Recognising previous feedback from Recfishwest that petroleum titleholders consult directly with those fishing clubs with regional proximity to Operational Areas, while providing information on activity EMBAs that may have broader implications for recreational fishers. This approach acknowledges DPIRD's estimated 620,000 recreational fishers in WA.
- Recognising AFANT's feedback that it will respond on an Association level and pass along any information to its members where required and relevant for their own individual feedback.

All authorities, persons and organisations engaged during the preliminary consultation and consultation phases were provided a link to the NOPSEMA brochure: Consultation on offshore petroleum environment plans.

A schedule of consultation activities is included at Table 4-8 and a schedule of advertising is included Table 4-9.

4.5.10 Reasonable period for consultation

Santos is required to allow a Relevant Person a reasonable period for consultation.

Santos provided approximately 70 days for feedback to be provided, from the start of preliminary consultation information being provided, to review and respond with feedback about the proposed activities (unless there was a reason for understanding sooner that the person or organisation did not require further consultation). In some cases, more time was provided. Santos also sought to accommodate reasonable requests for additional time.

Santos directly contacted Relevant Persons notifying them of the consultation process and consultation period. Emails or letters were sent to Relevant Persons to invite feedback for the EP, confirming the date by which feedback was sought and outlining how feedback may be provided. In other cases, one or more meetings were arranged, by agreement with the Relevant Person, for the purposes of the consultation.

Santos' preliminary consultation period also included a public awareness campaign, which ran from 9 to 22 November 2023 (Table 4-8), to seek out Relevant Persons and to raise public awareness of the Barossa Gas Project generally.

This was followed by a public awareness campaign from 23 November to 22 December 2023, specifically seeking feedback from Relevant Persons for this EP (Table 4-8).

4.5.11 Consultation opportunities

Santos offered multiple avenues and mediums for consultation, including:

- Provision of a toll free 1800 number;
- Dedicated email address;
- Community meetings and drop-in sessions; and
- In-person or virtual meetings, as appropriate.

Following initial correspondence and/or in person conversations, attempts were made (using different mediums) to follow up contact and a response if/where no response was received, e.g. by phone, email or letter, to confirm receipt of emails/letters and to prompt provision of a response. In most cases multiple follow-up attempts were made.

Table 4-8: Summary of Consultation Activities

Activity	Purpose	Timing
Preliminary Consultation		
Website: Website content and Activity fact sheets developed and made available at: https://www.santos.com/offshoreconsultation/	Provide Relevant Persons with: • Information about Santos' consultation obligations and approach. • Descriptions of proposed activities, including potential activity impacts and risks, and proposed management measures. • Contact details to enable Relevant Persons to provide feedback. • Information about how to self-identify as a Relevant Person, including an on-line nomination form. • Details about how feedback will be managed, including provision of Santos' offshore WA and NT privacy notice.	From 9 November 2023
Advertising: Advertisements in the following publications: • The Australian • NT News • Advertisements on the following radio stations: – Darwin Hot 100 – Darwin Mix 104.9.	Promote awareness of proposed activities to create opportunities for Relevant Persons to self-identify and seek feedback from Relevant Persons in addition to those identified by Santos as part of its initial public review process.	From 9 November 2023
Consultation materials: Email to identified/potential Relevant Persons with a link to the fact sheet for this EP	Provide Relevant Persons with details on proposed Activities and establish consultation expectations.	From 9 November 2023
One-to-one meetings: Meetings held with authorities, persons and organisations		From 9 November 2023
Consultation		
Consultation materials:	Reminder to Santos identified Relevant Persons of the	From 22 November 2023

Activity	Purpose	Timing
Email to identified Relevant Persons advising the commencement of consultation	commencement and closing dates for consultation.	
Advertising Advertisements in the following publications: • The Australian • NT News • Advertisements on the following radio stations: • Darwin Hot 100 • Darwin Mix 104.9	Promote awareness of proposed Activities and seek feedback from Relevant Persons.	From 22 November 2023
Consultation email: Reminder email to identified Relevant Persons advising pending closure of consultation period	Reminder to Santos identified Relevant Persons of the closing dates for consultation.	From 14 December 2023
Online meetings	Discussions with Relevant Persons who requested an online meeting.	November-December 2023
Meetings (in-person)	Provide Relevant Persons with information about this EP and discussions with Relevant Persons regarding this information.	November-December 2023

Table 4-9: Additional consultation advertising (November-December 2023)

Publication date	Advertising type	Towns / Communities	Reach
10 November 2023	Press ad – NT News	NT-wide	24,000
22, 25, 29 November 2023	Press ads – NT News	NT-wide	24,000
22 November and 6 December 2023	Press ad – The Australian	National	N/A
2, 6, 9, 13, 16, 19 December 2023	Press ads – NT News	NT-wide	24,000
27 November to 15 December 2023	Radio ads – Darwin Hot 100 50 X 30 sec spots	Darwin City, Greater Darwin and surrounds	N/A
4 December to 22 December 2023	Radio ads – Darwin Mix 104.9 50 X 30 sec spots	Darwin City, Greater Darwin and surrounds	N/A

4.6 Consultation report

A summary report including the outcomes of consultation with Relevant Persons, including any objections or claims and Santos' assessment of them, satisfying the requirements of section 24(b)(i)-(iii) of the OPGGS(E)R, is provided in Table 4-10. The full records of Relevant Persons consultation, as required by section 24(b)(iv) of the OPGGS(E)R, is provided in the Sensitive Information Report.

Of the Relevant Persons contacted, feedback on the Activity, environmental values and sensitivities, impacts/risks or control measures was received from the following:

- AusTurtle Inc via email
- One NT managed fishery licence holder via email
- Arafura Bluewater Charters via email
- ECNT via letter/email
- Wickham Point Deed liaison committee via a meeting
- The following First Nation Consultative Committees and coastal clan groups via meetings:
  - Agalda clan
  - Daly River / Port Keats First Nations Consultative Committee

- Mulyurrud Consultative committee
- Rak Badjalarr Consultative Committee
- Wulna clan

- The following Tiwi islands clan groups via meetings:
  - Jikilaruwu clan
  - Malawu clan
  - Mantiyupwu clan
  - Marrikawuyanga clan
  - Munupi clan.
  - Wulirankuwu clan
  - Wurankuwu clan
  - Yimpinari clan

Where objections or claims made during consultation were considered relevant to this EP, sections within this EP and the OPEP (BAS-210 0131) have been referenced within the consultation report (Table 4-10) for each objection or claim, showing where existing information relevant to that objection or claim is located. Where additional information or measures have been added to this EP or the OPEP (BAS-210 0131), as a result of the consultation undertaken, references to relevant sections have also been made.

Santos is committed to appropriate consultation post-acceptance of this EP with relevant government authorities and other relevant interested persons and organisations. Having regard to the nature of relevant interested persons and organisations, Santos' post acceptance consultation implementation strategy has been tailored to provide for effective consultation with different groups, based on Santos' experience consulting with these groups previously. Section 8.11 describes the Santos' post-acceptance consultation implementation strategy.

Table 4-10: Summary of consultation activities

Section 25(1)(a) of the OPGGS(E)R: Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant			
Australian Communications and Media Authority (ACMA)			
Summary of consultation effort: • On 9 November 2023 Santos emailed ACMA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236] • The email advised that Santos was seeking information to better understand: – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and – what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed DPD activities. • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023. • On 22 November 2023 Santos emailed ACMA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238] • On 13 December 2023 Santos followed-up the previous emails with a phone call to ACMA followed by an email on 20 December 2023. [Con-2894] • On 21 December 2023 ACMA responded to the phone calls via email to Santos stating it had no comments on the proposed activities and recommended that Santos contact the owners of any submarine cables (existing or planned) within the OA to discuss the activities. [Con-3296] • On 21 December 2023 Santos responded to ACMA via email and stated it was in regular contact with the relevant submarine cable owners and proponents. [Con-3306] See separate entries in this table for BW Digital, Sun Cable, Telstra, NT Power and Water and Vocus. • No further correspondence or feedback was received from ACMA.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
• No objections or claims were raised by ACMA. • ACMA recommended Santos engage with the owners of any submarine cables (existing or planned) within the OA to discuss the activities. [Con-3296]	Santos noted and actioned ACMA's advice.	Santos has engaged with the relevant owners of submarine cables (existing or planned) in preparing this EP [Con-3306]. See separate entries in this table for BW Digital, Vocus, Telstra and Sun Cable under Infrastructure owners/operators.	Refer to this consultation report table for consultation with owners of submarine cables. No updates or additional controls required.
Australian Fisheries Management Authority (AFMA)			
Summary of consultation effort: • On 9 November 2023 Santos emailed AFMA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236] • The email advised that Santos was seeking information to better understand: – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and – what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023. • On 22 November 2023 Santos emailed AFMA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238] • On 13December 2023 Santos followed-up the previous emails with a phone call to AFMA to remind it of the deadline for feedback. • On 14 December 2023 AFMA responded to the phone call via email Santos stating it had already responded when Santos requested feedback on its pipeline licence application for the DPD section in Commonwealth waters. [Con-3265] • On 15 December 2023 Santos responded to AFMA advising it would check this feedback. [Con-3307] • On 7 February 2024 Santos provided further response to AFMA confirming AFMA's standard advice for consultation direct with commercial fishing industry stakeholders. [Con-3328] • No further correspondence or feedback was received from AFMA.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
• No objections or claims were raised by AFMA. • AFMA referred Santos to its previous advice [Con-3265] which is that Santos should consult directly with commercial fishing industry stakeholders.	Santos noted and actioned AFMA's advice.	Santos advised it was consulting directly with relevant commercial fishing industry stakeholders in preparing this EP. [Con-3328]	Refer this consultation report table for consultation with commercial fishing stakeholders. No updates or additional controls required.
Australian Hydrographic Office (AHO)			
Summary of consultation effort: • On 9 November 2023 Santos emailed AHO to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236] • The email advised that Santos was seeking information to better understand: – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and – what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. • The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023. • On 22 November 2023 Santos emailed AHO further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238] • Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from AHO.			

Section 25(1)(a) of the OPGGS(E)R: Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
No objections or claims were raised by AHO.	In the absence of any specific response for the DP EP, Santos has reverted to the standard advice provided by AHO in response to requests for feedback during consultation on any EP.	• Santos will include all formal notification requirements in the relevant sections of this EP, specifically the following: • Requirement to notify the AHO through datacentre@hydro.gov.au no less than 4 working weeks before operations commence for the promulgation of related notices to mariners. • Requirement to notify AMSA's JRCC through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. • Santos also acknowledges the following standard AHO advice: • Vessel obligations to comply with the International Rules for Preventing Collisions at Sea (COLREGs), in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit. • Evaluation and implementation of adequate anti-collision measures, including the collision risk mitigation measures cited by AMSA, being additional warnings and/or lights to attract attention and offshore guard vessel/s that can monitor traffic and take early action to alert a vessel approaching the area of operations. • Santos' vessel anti-collision measures are in accordance with COLREGs and AMSA requirements. • Additionally, Santos will implement cautionary zones around Project vessels and use surveillance vessel to guard cautionary zones.	Notifications to AHO and AMSA JRCC are included in Table 8-5. Vessel anti-collision measures, in accordance with COLREGs and AMSA requirements, are included in control measures (refer to C6.1.1 and C6.1.2) and associated performance standards. Additionally, the implementation of speed restrictions and exclusion zones around the pipelay and construction vessels and use of surveillance vessel to act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay activities are included in control measures and associated performance standards (refer to C6.1.2 and C6.1.6). No updates or additional controls required.

Australian Institute of Marine Science (AIMS)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AIMS to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AIMS further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call to AIMS to remind it of the deadline for feedback. AIMS advised that it would not be providing any feedback.
- On 20 December 2023 Santos responded to AIMS via email confirming AIMS' comment during the phone call that it would not be providing any feedback. [Con-2910]
- No further correspondence or feedback was received from AIMS.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AIMS.	Nil	Nil	Nil

Australian Maritime Safety Authority (AMSA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AMSA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AMSA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from AMSA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AMSA.	In the absence of any specific response for this EP, Santos reverts to the standard advice provided by AMSA in response to requests for feedback during consultation on any EP.	• Santos will include all formal notification requirements in the relevant sections of this EP, specifically the following: • Requirement to notify AMSA's JRCC through rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings 24-48 hours before operations commence. • Requirement to notify the Australian Hydrographic Office through datacentre@hydro.gov.au no less than 4 working weeks before operations commence for the promulgation of related notices to mariners. • Santos also acknowledges the following standard AHO advice:	Notifications to AHO and AMSA JRCC are included in Table 8-5. Vessel anti-collision measures in accordance with COLREGs and AMSA requirements are included in a control measures (refer to C6.1.1 and C6.1.2) and associated performance standards. Additionally, the implementation of speed restrictions and exclusion zones around the pipelay and construction vessels and use of surveillance vessel to act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay activities are included in control measures and associated performance standards (refer to C6.1.2 and C6.1.6).

Section 25(1)(a) of the OPGGS(E)R: Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant			
		– Vessel obligations to comply with COLREGs, in particular, the use of appropriate lights and shapes to reflect the nature of operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit. – Evaluation and implementation of adequate anti-collision measures, including the collision risk mitigation measures cited by AMSA, being additional warnings and/or lights to attract attention and offshore guard vessel/s that can monitor traffic and take early action to alert a vessel approaching the area of operations. • Santos will provide AMSA with a copy of the accepted DPD EP.	No updates or additional controls required.

Department of Agriculture, Forestry and Fisheries (DAFF) – Biosecurity (marine pests) and Fisheries

Summary of consultation effort:

- On 9 November 2023 Santos emailed DAFF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  – what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 DAFF emailed Santos to acknowledge receipt of the email. [Con-3244]
- On 22 November 2023 Santos emailed DAFF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 November 2023 DAFF emailed Santos to acknowledge receipt of the email. [Con-3251]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DAFF.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DAFF.	In the absence of any specific response for this EP, Santos reverts to the standard advice provided by DAFF in response to requests for feedback during consultation on any EP.	All DAFF biosecurity requirements are understood and referenced in relevant commitments documented in this EP. Santos will report and engage directly with DAFF for the management of biosecurity risk post EP acceptance as stated in the cited offshore biosecurity guidelines and other associated documentation. Santos will continue to keep DAFF informed and incorporate DAFF's assistance offer into relevant management plans.	Notifications to DAFF are included in Table 8-5 Santos' environmental management framework relevant to biosecurity risk is outlined in Section 8.6.4 and 8.6.5 and is consistent with DAFF requirements. Adopted control measures are listed in Table 7-3. No updates or additional controls required.

Department of Climate Change, Energy, the Environment and Water (Underwater Cultural Heritage Branch)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DCCEEW's Underwater Cultural Heritage Branch to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  – what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DCCEEW's Underwater Cultural Heritage Branch further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DCCEEW's Underwater Cultural Heritage Branch.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DCCEEW (Underwater Cultural Heritage Branch).	In the absence of any specific response for this EP, Santos has reverted to advice provided by the Branch during the EPBC Act Referral assessment process with DCCEEW	Santos will ensure that requirements of the UCH Act are met as per previous DCCEEW advice.	Cultural heritage protected under the UCH Act is detailed in Sections 3.2.13.7 and 3.2.14. Section 8.6.6 describes the Protocol for Protection Underwater Cultural Heritage (PPUCH) in Commonwealth waters including unexpected finds protocols for maritime and First Nations UCH. Table 8-2 details the control measure (C6.2.9 and C6.2.11) and associated EPSs. Notifications required under the UCH Act are included in Table 8-5. No updates or additional controls required.

Department of Defence (DoD)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DoD to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP. [Con-3236]
- The email advised that Santos was seeking information to better understand:

Section 25(1)(a) of the OPGGS(E)R: Commonwealth agency or authority to which the activities to be carried out under the environment plan may be relevant

  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DoD further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DoD.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No correspondence was received from DoD. Santos engages with the Department on an ongoing basis to provide operational updates on current and proposed offshore activities and schedules.	Santos has followed DoD's standard advice for all Barossa Project EPs.	Santos is aware of the potential presence of unexploded ordnance in the military exercise area within the EMBA and related responsibilities of an Operator. UXO surveys have been undertaken in preparation for the activity. Procedures to mitigate risks to unexpected maritime heritage objects (i.e. the UFP for maritime underwater cultural heritage – Attachment 1 of the PPUCH), inclusive of a stop work protocol, will be in place for the activity and includes for identification of UXO amongst other objects.	DoD activity notifications are included in Table 8-5. Section 8.6.6 describes the PPUCH. Table 8-2 details the control measure (C6.2.9) and associated EPSs. No updates or additional controls required.

Department of Home Affairs (DHA) / Australian Border Force (ABF)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DHA/ABF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DHA/ABF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos had a telephone discussion with the DHA/ABF during which DHA stated that its interest in the Barossa Project was only related to the required maritime security plan and it would consult with Santos on the development of that plan at the appropriate time.
- On 21 December 2023 Santos emailed DHA/ABF to confirm the advice provided by DHA/ABF during the telephone discussion of 13 December 2023. [Con-2896].
- On 23 January 2024 ABF emailed Santos to advise that Santos is a potential operator in 3 scenarios that would require an approved security plan to be maintained. [Con-3206]
- On 12 February 2024 Santos emailed DHA/ABF to confirm that, separate to this EP consultation process, contact had previously been initiated and was ongoing with DHA regarding the requirements outlined in the *Maritime Transport and Offshore Facilities Security Act 2003* (Cth). [Con-3207]
- No further correspondence or feedback was received from DHA/ABF relevant to this consultation.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DHA/ABF.	Nil	Nil	Nil

Department of Industry, Science and Resources (DISR)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DISR to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DISR further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to DISR requesting any feedback by 22 December 2023. [Con-2897]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DISR.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DISR.	Nil	Nil	Nil

Director of National Parks (DNP)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DNP to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and

– what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DNP further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 6 December 2023 DNP emailed Santos stating that unless the Barossa project had materially changed it had no comments to provide on this EP. [Con-3260]
- No further correspondence or feedback was received from DNP.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DNP.	The Barossa Project has not materially changed. In the absence of any specific response for this EP, Santos has reverted to the standard advice provided by Parks Australia in response to requests for feedback during consultation on EPs.	In preparing this EP, Santos has completed the following actions: • Considered the NOPSEMA Petroleum Activities and Australian Marine Parks Guidance Note. • Identified and proposed management measures for all impacts and risks on Australian marine park values (including ecosystem values) to an acceptable level and considered all options to avoid or reduce them to as low as reasonably practicable. • Demonstrated that the activity will not be inconsistent with the relevant marine parks management plan(s). • Incorporated all DNP emergency response notification requirements in the relevant sections of this EP.	Australian Marine Parks are identified and described in Section 3.2.11.2. An assessment of impacts/risk against Australian Marine Park objectives is included in Section 7.6 and 7.7. Table 8-5 and OPEP (BAS-210 0131) details the DNP emergency notification requirements. No updates or additional controls required.

Fisheries Research and Development Corporation (FRDC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed FRDC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  – what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed FRDC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call to FRDC reminding it of the deadline for feedback.
- On 13 December 2023 FRDC responded to the phone call via email to Santos stating it had forwarded Santos' correspondence to the relevant parties within its organisation. [Con-3261]
- On 20 December 2023 Santos responded to FRDC via email with a reminder to provide any feedback by 22 December 2023. [Con-2898]
- Notwithstanding the information provided, no further correspondence or feedback was received from FRDC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by FRDC.	Nil	Nil	Nil

Indigenous Land and Sea Corporation (ILSC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed ILSC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  – if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  – what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.

- On 14 November 2023 Santos sent the email of 9 November 2023 to an additional ILSC email address. [Con-3294]
- On 22 November 2023 Santos emailed ILSC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 15 December 2023 and 9 January 2024 Santos followed-up the previous emails with phone calls to ILSC reminding it of the deadline for feedback.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from ISLC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by ILSC.	Nil	Nil	Nil

National Indigenous Australians Agency (NIAA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed NIAA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NIAA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous email with a phone call to NIAA reminding it of the deadline for feedback.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NIAA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NIAA.	Nil	Nil	Nil

Section 25(1)(c) of the OPGGS(E)R: Department of the responsible Northern Territory Minister

Department of Industry, Tourism and Trade, NT – Energy Division (DITT-NT Energy)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DITT-NT Energy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DITT-NT Energy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DITT-NT Energy.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DITT-NT Energy. Santos has been meeting with DITT-NT Energy outside of the Relevant Person consultation process on the requirements of the DPD Offshore CEMP submission to meet the requirements of the *Petroleum (Submerged Lands) Act 1981* (NT) / OPGGS(E)R for activities in NT coastal waters and the requirements of the *Energy Pipelines Act 1981* (NT) for activities in NT internal waters.	Nil	Nil	Nil

Section 25 (1)(a) of the OPGGS(E)R: Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant

Aboriginal Areas Protection Authority (AAPA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AAPA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Santos sent an additional email to AAPA advising that Santos would be happy to meet with AAPA to discuss the information, suggested a potential week for a meeting and provided additional telephone contact details. [Con-3287]
- On 22 November 2023 Santos emailed AAPA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 November 2023 AAPA emailed Santos stating it considered itself a Relevant Person for the consultation of this EP and DPD Offshore CEMP and would submit comment by 22 December 2023. [Con-3254]
- On 15 December 2023 and 9 January 2024 Santos followed-up the previous emails with phone calls to AAPA reminding it of the deadline for feedback.

- Notwithstanding the information provided and the steps described above, no further comments or input were received on this EP from AAPA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AAPA for this EP. Santos has met with AAPA outside of the Relevant Person consultation process regarding Authority Certificate applications for the DPD Project in NT waters, which is in the EMBA of this EP. Santos has received Authority Certificates for certain seabed/land disturbance works in NT waters for the DPD Project.	Nil	Nil	Section 3.2.14.6 acknowledges that there are sacred sites, including those registered with AAPA, within the EMBA. The regulatory requirements of the NTASS Act are provided in Sections 3.2.14.2, 3.2.14.6 and Appendix B. Section 8.6.6 describes the PPUCH. Table 8-2 details the control measure (C6.2.11) and associated EPSs. Table 8-5 lists the notifications to Relevant Persons and requirements under the UCH Act. No updates or additional controls required.

Department of Environment, Parks and Water Security (DEPWS)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DEPWS to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests, or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DEPWS further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 DEPWS responded via email to Santos stating it had provided its feedback on the DPD to the NT Environment Protection Authority's assessment process for the DPD in NT waters. [Con-3267]
- No further correspondence or feedback was received from DEPWS.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DEPWS. DEPWS referred to feedback provided to the EPA (NT). DEPWS raised that it has provided feedback to the EPA (NT) through the DPD Project assessment process under the *Environment Protection Act 2019 (NT)*. DEPWS feedback from the Flora and Fauna Division was provided to the EPA (NT) on the DPD Project Referral and the Supplementary Environmental Report (SER), which attached draft management plans, including a draft of the Offshore CEMP. Santos responded to DEPWS feedback on the Referral as required within the SER. EPA (NT) considered DEPWS feedback on the SER in its report recommending approval of the DPD Project.	Nil	Nil	Nil

Department of Industry, Tourism and Trade – Fisheries Division (DITT-NT Fisheries)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DITT-NT Fisheries to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DITT-NT Fisheries further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DITT-NT Fisheries.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DITT-NT Fisheries. Santos met with DITT-NT Fisheries outside of the Relevant Person consultation process regarding a *Fisheries Act 1988* (NT) section 11 Permit (2023-2024/ S11/ 524) for activities in NT internal waters.	Nil	Nil	Nil

Department of Infrastructure, Planning and Logistics – Transport (DIPL-NT-Transport)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DIPL-NT-Transport to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DIPL-NT-Transport further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call to DIPL-NT-Transport reminding it of the deadline for feedback.
- On 14 December 2023 the Regional Harbourmaster's Office within DIPL-NT-Transport responded via email and requested an extension of time to respond. [Con-3030]
- On 22 December 2023 Santos responded to the Regional Harbourmaster, advising that an extension could be accommodated until mid-January for feedback. [Con-3270]
- On 22 December 2023 the Regional Harbourmaster acknowledged Santos' email of the same day. [Con-3216]
- No further correspondence or feedback was received from DIPL-NT-Transport.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DIPL-NT-Transport. Santos has met with DIPL-NT-Transport outside of the Relevant Person consultation process regarding approval of the pipeline route within Darwin Harbour and with respect to a Traffic Impact Assessment for road transport associated with DPD Project. Requirements raised through the *Environment Protection Act 2019 (NT)* assessment process have been met. The pipeline route through Darwin Harbour is entirely within NT internal waters which are not covered by the OPGGS(E)R.	Nil	Nil	Nil

Department of Police, Fire and Emergency Services

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT Police, Fire and Emergency Services to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT Police, Fire and Emergency Services further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to NT Police, Fire and Emergency Services requesting any feedback by 22 December 2023. [Con-2900]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NT Police, Fire & Emergency Services.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NT Police, Fire and Emergency Services.	Nil	Nil	Nil

Department of Territory Families, Housing and Communities, NT Heritage branch (DTFHC-NT-Heritage)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DTFHC-NT-Heritage to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DTFHC-NT-Heritage further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to DTFHC-NT-Heritage requesting any feedback by 22 December 2023 [Con-3263].
- On 20 December 2023 DTFHC-NT-Heritage responded to Santos via email stating it was in ongoing consultation with Santos' project managers and providing timely responses on the DPD Project. [Con-3208]
- On 21 December 2023 Santos emailed DTFHC-NT-Heritage to confirm the ongoing consultation on the DPD Project. Santos stated it would contact DTFHC-NT-Heritage in the new year to check if it had any specific comments related to this EP. [Con-3209]
- On 12 January 2024 Santos followed up the 21 December 2023 email with a phone call to DTFHC-NT-Heritage to determine whether the Department had feedback.
- No further correspondence or feedback was received from DTFHC-NT-Heritage.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DTFHC-NT-Heritage. Santos has engaged with DTFHC-NT-Heritage outside of the Relevant Person consultation to meet its obligations under the UCH Act and the *Heritage Act 2011* (NT) including provision of a maritime archaeologist assessment of the project footprint in order to identify potential underwater cultural heritage objects and for assessment reports to be provided to DTFHC-NT-Heritage. Further to this, it is a condition of DPD Project approval under the *Environment Protection Act 2019* (NT) for Santos to develop a CHMP including procedures to mitigate risks to unexpected maritime heritage objects. Santos has provided the maritime archaeological heritage assessment report and unexpected finds protocol to DTFHC-NT-Heritage and will provide DTFHC-NT-Heritage with any further updates of these documents.	Nil	Nil	Nil

Environment Protection Authority (NT) (EPA (NT))

Summary of consultation effort:

- On 9 November 2023 Santos emailed EPA (NT) to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed EPA (NT) further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call to EPA (NT) reminding it of the deadline for feedback.
- On 14 December 2023 the EPA (NT) responded to Santos via email referring Santos to the EPA (NT)'s completed assessment for the DPD in NT Waters and advising it had no comments or feedback on this EP. [Con-3266]
- No further correspondence or feedback was received from EPA (NT).

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by EPA (NT). Santos has engaged with EPA (NT) through the DPD Project formal assessment process under the *Environment Protection Act* 2019 (NT). The EPA (NT) assessment considered the DPD Project SER, which was provided with the draft Offshore CEMP as an attachment. The DPD Project activity in NT inland waters is now approved, subject to conditions, as per Environmental Approval EP2022/022-001.	Nil	Nil	Nil

NT Power and Water Corporation

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT Power and Water Corporation to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT Power and Water Corporation further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call to NT Power and Water Corporation reminding it of the deadline for feedback.
- On 20 December 2023 Santos followed up its phone call of 13 December with a further email reminder of the deadline for feedback. [Con-2903]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NT Power and Water Corporation.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NT Power and Water Corporation.	Nil	Nil	Nil

NT Parks and Wildlife Commission

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT Parks and Wildlife Commission to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT Parks and Wildlife Commission further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]

- On 13 December 2023 Santos followed-up the previous emails with a phone discussion with Parks and Wildlife Commission during which a representative confirmed the previous Santos emails had been forwarded to the appropriate person.
- On 20 December 2023 Santos followed-up with an email to the NT Parks and Wildlife Commission reminding it of the 22 December deadline for feedback and comments [Con-2905]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NT Parks and Wildlife Commission.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NT Parks and Wildlife Commission.	Nil	Nil	Nil

Tourism NT

Summary of consultation effort:

- On 9 November 2023 Santos emailed Tourism NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3281], [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos advised Tourism NT that the information had also been provided to a range of Darwin-based tourism operators and Santos would be happy to arrange a meeting to discuss the information.
- On 22 November 2023 Santos emailed Tourism NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call to Tourism NT during which Tourism NT advised it would not be making any comments.
- On 20 December 2023 Santos provided Tourism NT with an email record of the phone call. [Con-2906]
- No further correspondence or feedback was received from Tourism NT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Tourism NT.	Nil	Nil	Nil

Section 25 (1)(a) of the OPGGS(E)R: Western Australia agency or authority to which the activities to be carried out under the environment plan may be relevant

Department of Primary Industries and Regional Development – Fisheries (DPIRD-WA Fisheries)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DPIRD-WA-Fisheries to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DPIRD-WA-Fisheries further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to DPIRD-WA Fisheries requesting any feedback by 22 December 2023. [Con-2908]
- On 20 December 2023 DPIRD-WA Fisheries advised via email that it had returned the phone call on 13 December 2023 via a Santos 1800 number. [Con-3210]
- On 21 December 2023 Santos emailed DPIRD to advise the call related to an Environment Plan for additional pipeline to the south of the Tiwi Islands and comments previously provided may also apply, and Santos will get back in touch in 2024 in relation to the consultation process for future EPs. [Con-3211]
- On 21 December 2023 Santos had a telephone discussion with DPIRD-WA-Fisheries during which the Department advised that it was unlikely to comment on this EP and was happy to discuss the consultation process for future EPs with Santos in the new year.
- No further correspondence or feedback was received from DPIRD-WA-Fisheries.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DPIRD-WA-Fisheries.	Nil	Nil	Nil

Department of Transport (DoT-WA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed DoT-WA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed DoT-WA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 23 November 2023 DoT-WA emailed Santos stating it should be contacted if there is a risk of a spill impacting State waters from any of the proposed activities [Con-3255]. DoT's requirement is noted and not relevant to the EMBA.

- On 14 December 2023 DoT-WA emailed Santos to advise they wished to be consulted if any works or deployments are within WA State Waters [Con-3212].
- On 20 December 2023 Santos emailed DoT-WA to acknowledge their feedback. [Con-3213]
- On 7 February 2023 Santos emailed DoT-WA to advise that the project does not include any works or deployments within WA State Waters. [Con-3214]
- No further correspondence or feedback was received from DoT-WA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DoT-WA.	Santos acknowledges the requirement for DoT to be contacted for any hydrocarbon spill entering WA state waters.	An evaluation of spill modelling predicts no contact with WA waters.	Nil

Section 25 (1)(d) of the OPGGS(E)R: Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan

Academic and Research Organisations

Arafura Timor Research Facility

Summary of consultation effort:

- On 9 November 2023 Santos emailed AIMS, in its capacity as operator of the Arafura Timor Research Facility, to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AIMS further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 and 20 December 2023 Santos followed-up the previous emails with phone calls to AIMS in which AIMS advised that it would not be providing any feedback.
- On 20 December 2023 Santos responded to AIMS via email confirming the comment provided in the phone call. [Con-2910]
- No further correspondence or feedback was received from AIMS.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by the Arafura Timor Research Facility.	Nil	Nil	Nil

Australian Marine Sciences Association – NT (AMSA-NT)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AMSA-NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AMSA-NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to AMSA-NT requesting any feedback by 22 December 2023. [Con-2911]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from AMSA-NT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AMSA-NT	Nil	Nil	Nil

AusTurtle Inc

Summary of consultation effort:

- On 9 November 2023 Santos emailed AusTurtle Inc to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AusTurtle Inc further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Santos followed-up the previous emails with a phone call on 15 December 2023 and then a follow-up email on 20 December 2023 reminding AusTurtle Inc of the deadline for feedback. [Con-2936]
- 29 December 2023 AusTurtle Inc responded via email to Santos and provided feedback as stated in the summary of Objection or Claim below. [Con-3311]

- On 12 January 2024 Santos attempted to contact AusTurtle Inc by phone to acknowledge the feedback provided.
- On 12 February 2024 Santos emailed AusTurtle Inc in response to its feedback. Santos thanked AusTurtle for its comments which were in-line with its previous comments and Santos' understanding of AusTurtle Inc's views. [Con-3312]
- No further correspondence or feedback was received from AusTurtle Inc.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
AusTurtle advised the following in relation to flatback sea turtles: • AusTurtle has monitored nesting flatback sea turtles since 1996 on Bare Island which is located at the edge of the MEVA. • During construction of the Bayu-Undan to Darwin gas pipeline from 2004-2006 and the Inpex Ichthys gas pipeline in 2014-2016 there was no detectable impact on the numbers of nesting turtles. • The DPD section will pass through the flatback turtle internesting area where gravid females will dive to depths of 40 m and rest on the bottom to surface every hour or so to breathe. • The previous pipelines had no detectable impact as is expected with this pipeline. • Any impact, including attraction to lights, is likely to be on individuals rather than the population. [Con-3311]	The information provided by AusTurtle is aligned with Santos' understanding and assessment in this EP.	Santos thanked AusTurtle for its comments which were in-line with its previous comments and Santos' understanding. [Con-3312]	The advice that the DPD route will pass through a flatback turtle internesting BIA is consistent with the information presented in Section 3.2.12.2.1 and impact assessment in Section 7.3. The advice that any impact, including attraction to lights, is likely to be on individuals rather than the population is consistent with the impact assessment provided in Section 6.4. Project light emissions were assessed to have a minor impact on marine ecosystems (including marine fauna), meaning an "Insignificant disruption to the breeding cycle of a local population/ area of occupancy of a species/ loss of habitat critical to the survival of a species/ values of a protected area."

Charles Darwin University (CDU)

Summary of consultation effort:

- On 9 November 2023 Santos emailed CDU to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed CDU further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to CDU requesting any feedback by 22 December 2023. [Con-2912]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from CDU.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Notwithstanding the information provided and the steps described above, no comments or input were received on this EP by CDU.	Nil	Nil	Nil

Darwin Harbour Advisory Committee (DHAC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed all DHAC members to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2022 Santos separately emailed the DHAC Chair and Executive Officer to offer a meeting with the committee to discuss the information. [Con-3284]
- On 22 November 2023 Santos emailed DHAC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from DHAC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by DHAC.	Nil	Nil	Nil

Commercial Fishing: Commonwealth-managed fisheries

Northern Prawn Fishery (NPF) Licence Holders (in addition to the consultation undertaken with representative body Northern Prawn Fishery Pty Ltd)

Summary of consultation effort:

- Formal consultation with NPF Licence Holders occurs via their representative association, the Northern Prawn Fishing Industry (NPFI) Ltd (see separate NPFI entry). This is the process requested by the NPFI and licence-holders.
- On 9 November 2023 Santos emailed NPF Licence Holders who had supplied email addresses to advise them of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NPF Licence Holders who had supplied email addresses further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with phone calls to NPF Licence Holders who had supplied telephone contact details.
- On 19 and 20 December 2023 Santos followed-up the phone calls to NT Licence Holders with further emails to NT Licence Holders who had supplied email contact details. [Con-2913], [Con-2914], [Con-2916], [Con-2923]
- On 20 December 2023 Austral Fisheries responded to Santos via email stating it was already working with Santos' Consultation Coordinator for the Barossa Project. [Con-3313].
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from individual NPF licence-holders.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Nil	Nil	Nil	Nil

Southern Bluefin Tuna/ Western Skipjack Tuna and Western Tuna and Billfish Fisheries Licence Holders

Summary of consultation effort:

- These stakeholders were consulted via their representative body, the Australian Southern Bluefin Tuna Industry Association (ASBTIA). Refer to ABSTIA entry in this table for details.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Refer to ABSTIA entry.	Nil	Nil	Nil

North-West Slope Trawl Fishery Licence Holders

Summary of consultation effort:

- These stakeholders were consulted via their representative body, the Western Australian Fishing Industry Association (WAFIC). Refer to WAFIC entry in this table for details.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Refer to WAFIC entry.	Nil	Nil	Nil

Commercial Fishing: NT-managed fisheries Licence Holders (Aquarium Fishery, Bait Net Fishery, Barramundi Fishery, Coastal Line Fishery, Coastal Net Fishery, Demersal Fishery, Development (Small Pelagic), Mud Crab Fishery, Offshore Net and Line Fishery, Pearl Oyster Fishery, Spanish Mackerel Fishery, Timor Reef Fishery, Trepang Fishery)
(In addition to consultation undertaken with the Northern Territory Seafood Council)

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT Licence Holders who had supplied email addresses to advise them of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- The initial consultation notification and supporting information was also posted to all NT Licence Holders as per the process requested by their representative body, the NT Seafood Council.
- On 22 November 2023 Santos emailed NT Licence Holders who had supplied email addresses further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 and 15 December 2023 Santos followed-up the previous emails with phone calls to NT Licence Holders who had supplied telephone contact details.
- On 19 December 2023 Santos followed-up the phone calls to NT Licence Holders with further emails to NT Licence Holders who had supplied email contact details. [Con-2917], [Con-2919], [Con-2921], [Con-2918], [Con-2914], [Con-2920]
- On 19 December 2023, an NT Licence Holder responded to Santos via email requesting that it be kept updated during the project as it had vessels operating in the relevant area at times [Con-3218]
- On 20 December 2023 Austral Fisheries responded to Santos via email stating it was already working with Santos' Consultation Coordinator for the Barossa Project. [Con-3313]
- On 4 January 2024 an NT Licence Holder phoned Santos to express concern at potential impact from the DPD pipelay works south of the Tiwi Islands on his fishing activities. The Licence Holder was asked to provide details in writing to Santos and an email was provided on 5 January 2024 [Con-3314]
- On 8 January 2024 Santos emailed the Licence-Holder asking if they could provide dates suitable to them for a discussion on his concerns. [Con-3315]

- On 9 January 2024 Santos also emailed the Licence-Holder's representative body, the NT Seafood Council (NTSC), to advise it of the correspondence with the Licence Holder, a potential meeting and whether the NTSC and any other person would like to be involved. [Con-3316]
- On 19 January 2024 Santos unsuccessfully attempted to contact the Licence-Holder by phone to gain further information and arrange a meeting.
- On 22 March 2024 Santos again emailed the Licence-Holder who had expressed concern about the activities and provided further opportunity to provide input by 28 March 2024 to the development of this EP. The email was again copied to the fishers representative body, the NTSC. [Con-3532] No response was received. Santos will continue to keep the Licence-Holder updated as part of its ongoing Barossa Project communications.
- No further correspondence or feedback was received from individual licence-holders.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
One licence-holder expressed a concern at potential fishing impacts within a 5.5 km distance from the work being carried out by Santos.	No information, other than a short email, has been provided. The claim does not contain any detail about the alleged potential impacts of DPD Project activities on the licence holder to allow Santos to assess that claim.	The initial consultation notification and supporting information was posted to the licence holder. Santos has sought information from the Licence-Holder over a period of just under 3 months via email and phone (on multiple occasions) and has sought to organise a meeting with the Licence-Holder and their representative body. No responses have been received to date. Based on the email, the licence holder appears to be concerned about potential impacts on fishing within a 5.5km distance from the work that will be carried out by Santos. However, potential impact will be very limited as the work will be of a short duration and an exclusion zone will only be in operation around moving vessels while the pipeline is being installed. Once installed, there is no permanent exclusion zone around the installed pipeline.	Santos has recognised commercial fishing activities within Section 3.2.13.1. Potential impacts to other marine users, including commercial fishers, from DPD Project activities are acknowledged and evaluated in Section 6.1 and the control measures and associated performance standards relevant to other marine user interactions are provided in Table 8-5.
One licence holder requested that it be kept updated during the project as it had vessels operating in the relevant area at times	The request does not include any objections or claims.	Santos ensures this licence-holder is kept updated on the project at all times, including communications prior and during the activities for this EP.	Control measures and associated performance standards relevant to other marine user interactions are provided in Table 8-5.

Commercial Fishing: WA-managed fisheries Licence Holders (entitled to fish in EMBA)

Summary of consultation effort:

- These Licence Holders were approached via their representative body, the WAFIC. Refer to the WAFIC entry in this table for details of its consultation requirements.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Refer to WAFIC entry	Nil	Nil	Nil

Energy Industry

Energy Industry Operators: (Eni Australia, INPEX, Melbana, MEO, Neptune Energy, Shell Development, Woodside Energy)

Summary of consultation effort:

- On 9 November 2023 Santos emailed Energy Industry Operators to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Energy Industry Operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Between 14 and 18 December 2023 Santos made phone calls to the relevant operators (Eni Australia, INPEX, Melbana, MEO, Neptune Energy, Shell Development, Woodside Energy) reminding them of the deadline for feedback. Messages and follow-up emails were provided to those who could not be contacted:

- On 14 December 2023 Santos followed-up the previous emails with a phone call to INPEX and a follow-up email on 20 December 2023. [Con-2927].
- On 21 December 2023 INPEX responded via email to Santos stating it was working with the Barossa Team on an operational level with INPEX's focus being environmental input for the approval to lay the DPD near its Ichthys GEP in NT waters. [Con-3317]
- On 18 December 2023 Santos followed-up the previous emails with a phone call and email to Eni [Con-2925]
- On 14 December 2023 Santos followed-up the previous emails with a phone call to MEO and a follow-up email on 19 December 2023. [Con-2934]
- On 14 December 2023 Santos followed-up the previous emails with a phone call to Neptune Energy and a follow-up email. [Con-2933]
- On 14 December 2023 Neptune Energy responded via email to Santos and advised they supported the project and would like to be included in any future communications and did not provide any comments on this EP or DPD Offshore CEMP. [Con-3271]
- On 14 December 2023 Santos followed-up the previous emails with a phone call to Shell and a follow-up email on 20 December 2023. Shell advised they do not consider themselves a relevant person. [Con-2930]
- On 18 December 2023 Santos followed-up the previous emails with a phone call to Woodside and a follow-up email on 19 December 2023. [Con-2931]
- On 20 December 2023 Woodside responded via email to Santos stating it had no comments on the proposed activity. [Con-3318]
-

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Energy Industry Operators.	Nil	Nil	Nil

Environmental Organisations

Australian Marine Conservation Society – NT branch (AMCS-NT)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AMCS-NT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AMCS-NT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed up the previous emails by phone and left a message.
- On 19 December 2023 Santos followed up the phone call with another email to AMCS-NT requesting any feedback by 22 December 2023. [Con-2935]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from AMCS-NT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AMCS-NT.	Nil	Nil	Nil

Conservation Council of WA (CCWA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed CCWA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed CCWA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone discussion with CCWA confirmed it had received the previous emails, did not have any feedback at this time but may request an extension to respond. On 21 December 2023, Santos confirmed this in an email to CCWA. [Con-2937]
- On 4 January 2024 CCWA responded to Santos via email stating it was unable to provide consultation at this stage but would engage through the NOPSEMA process. [Con-3319]
- On 22 March 2024 Santos emailed CCWA and provided further opportunity to provide input by 28 March 2024 to the development of this EP [Con-3529]
- Notwithstanding the information provided and the steps described above, no comments or input were received for this EP from CCWA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by CCWA.	Nil	Nil	Nil

Environment Centre NT (ECNT)

Summary of consultation effort:

- On 9 November 2023 Santos emailed ECNT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed ECNT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 December 2023 ECNT emailed Santos attaching a letter requesting further information about certain aspects of DPD activities. The ECNT's objections, claims and requests for information and Santos' responses to each are detailed in the assessment section of this entry. [Con-3320]
- On 9 February 2024 Santos emailed ECNT in response to its email of 22 December 2023 and provided responses to the matters raised in ECNT's letter of 22 December 2023. [Con-3321]
- No further correspondence or feedback was received from ECNT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
ECNT reasserted that it is a Relevant Person under the OPGGS(E)R for this EP and DPD Offshore CEMP.	Santos notes ECNT is a Relevant Person.	No response required.	No updates or additional controls required.
Seabed disturbance: • ECNT claimed the information provided in the Information Booklet provided by Santos did not have enough detail. • ECNT claimed the absence of sediment dispersal modelling for mass flow excavation and pipelay made it impossible to assess the impacts of the proposed activity on the seabed. • ECNT requested Santos confirm whether more complete models of seabed disturbance have been conducted and make them available.	Mass flow excavation (MFE) is not an activity covered under this EP. Santos believes ECNT has been provided with sufficient information to assess the potential impacts, risks and proposed control measures for the proposed activity on the ECNT's functions, interests and activities and to provide feedback.	MFE may be undertaken in localised areas within NT waters but will not be undertaken in Commonwealth waters. Impacts to the seabed from pipelay are assessed to be minor. Sedimentation/turbidity effects associated with the Activity are predicted to be temporary and very localised. On that basis, Santos does not consider sediment dispersion modelling for the pipelay in Commonwealth waters to be warranted, and that the impacts of these activities are already adequately understood and assessed.	Potential impacts to seabed from the Activity are acknowledged and evaluated in Section 6.2 and the control measures and associated performance standards are provided in Table 6-3.
Light pollution: • ECNT claimed a 2018 study of Flatback Turtle hatchlings found that artificial light at sea causes disorientation and creates greater risk of predation. • ECNT claimed Santos does not appear to have considered the impacts of artificial light on turtle hatchlings undertaking ocean dispersal.	Santos acknowledges that there are studies showing that artificial light at sea can cause disorientation and increase predation risk to turtle hatchings. Santos rejects the assertion that it has not considered the impacts of artificial light on turtle hatchlings undertaking ocean dispersal.	Santos has considered potential impacts from DPD Project lighting to nesting turtles and turtle hatchlings, including potential impacts to turtle hatchling ocean dispersal activity. The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings following emergence from nests by light spill on beaches. The National Light Pollution Guidelines states that within 15 km of the nesting beach, light impacts may affect flatback hatchling behaviours. The distance of the OA from the closest significant turtle nesting beaches at Cape Fourcroy is approximately 25 km. Santos has conducted a light modelling study to determine the distance away from Project vessels where light could possibly cause behavioural disturbance to turtle hatchlings. This was determined as within 3.3 km of the pipelay vessel, 2.5 km of the offshore construction vessel, and 4.5 km when these vessels are operating side by side. Given the furthest extent of potential impacts from vessel lighting is located beyond the 15 km of nesting beaches	Light emission impacts to marine turtles, including the impact of disorientating hatchlings and increasing predation of hatchlings being caught in vessel 'light pools' is included in Section 6.4 and references the results of a vessel light spill modelling study conducted for the Barossa Project. The control measures relevant to vessel lighting impacts are included in Section 6.4.3 with performance standards included in Table 8-2. Santos has not adopted further control measures.

		identified by the National Light Pollution Guidelines as the relevant zone within which light impacts may affect hatchlings, and the short duration (i.e. days) these vessels will be on location, the risk of Project vessel lighting to turtle hatchlings that disperse from Cape Fourcroy or other more distant locations is not considered significant.	
Noise pollution: • ECNT claims that within the DPD Preliminary Documentation Report (PDR) Santos has relied on limited sources to establish a single behavioural threshold for all sea turtles. • ECNT cited part of Santos' booklet stating that "there is a relatively low probability of encountering significant numbers of noise-sensitive fauna," and that "transiting marine fauna are expected to demonstrate short-term avoidance behaviour within the operational area." • ECNT claimed avoidance behaviour is an insufficient way to manage the impacts of noise pollution and that avoidance is a behavioural change in itself and behavioural changes, such as reduction in foraging and interference with biological signals. Impacts on turtle stocks and species viability may be amplified during the internesting period when some DPD activities will occur. • ECNT claimed Santos has not provided complete information about the risks and impacts on marine megafauna, in particular the impacts of light and noise pollution on turtles. ECNT requested a complete profile of impacts to marine megafauna associated with light and noise pollution, taking into account the internesting period expected to overlap with project activities, and impacts on Flatback turtle hatchlings undertaking ocean dispersal.	Santos considers it has used appropriate behavioural thresholds for marine turtles. Santos confirms the statement from its Information Booklet which is applicable to DPD Project activities in Commonwealth. Santos acknowledges that avoidance behaviour is a behavioural impact but does not rely on this aspect alone in terms of managing noise impacts. Santos considers the existing management measures in place reduce impact to ALARP and acceptable levels. Santos has considered a complete profile of impacts and risks to marine fauna, including, light and noise emissions, considering internesting turtles and turtle hatchlings.	• The OA has water depths greater than 50 m and therefore does not contain turtle foraging habitat. Flatback turtles may transit the OA during the peak internesting period (June to September). Other species of turtles (green, olive ridley, loggerhead, leatherback, hawksbill) may transit the OA to forage at shoals and banks located outside of the OA. • Santos will not rely on turtle avoidance behaviour alone as the means of managing impacts from underwater noise. The management measures for reducing impacts to marine turtles in this EP include: • vessels complying with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) with respect to marine fauna interactions; • maintenance of noise generating equipment (e.g. vessel engines), undertaken as per the vessels' planned maintenance system; • the presence of crew members trained in marine fauna observation on the pipelay vessel, including one crew member trained in marine fauna observation on the vessel bridge at all times; and • the undertaking of vessel inductions by crew members, including marine fauna risks and controls. • Santos recognises that avoidance is a behavioural response to underwater noise. However, due to the wide distribution of foraging habitat, the short duration of DPD Project activities (including pipelay) and the nearest significant turtle nesting beaches being 25 km away, these responses are not likely to have a significant	An assessment of impacts and risks to marine fauna, including noise and light emissions, inclusive of internesting and hatchling marine turtles, is presented in Section 6.3 and 6.4 and an evaluation of ALARP and acceptability provided in Sections 6.3.6 and 6.4.6. The control measures relevant to underwater noise emissions and light emissions are provided in Sections 6.3.3 and 6.4.3, respectively, with associated management measures inclusive of performance standards included in Table 8-2. No updates or additional controls required.

		impact on turtles. With the implementation of control measures, Santos considers that impacts are reduced to as low as reasonably practicable and an acceptable level.	
Rationale for project: • ECNT claimed the risks involved in transporting gas to the existing Darwin LNG facility for processing are greater than the alternative of connecting the existing Bayu-Undan Gas Export Pipeline to the Barossa Field. • ECNT claimed Santos cannot demonstrate the viability of the proposed Bayu-Undan Carbon Capture and Storage facility and thus the need for the DPD Project. • ECNT requested any information available that demonstrates certainty around the necessity of the DPD Project. • ECNT suggested Santos delay submitting this EP until all approvals for the Bayu-Undan CCS plan, in both Australia and Timor-Leste, have been granted.	Santos has already explained the justification for the DPD Project in submissions it has made in connection with the approval assessment processes for the DPD Project under the *Environment Protection Act 2019 (NT)* and EPBC Act. The submissions are publicly available. Santos does not consider justification of the Project or an assessment of alternatives is within the scope of this EP or required under the OPGGS(E)R.	The OPGGS(E)R do not require an EP to demonstrate 'certainty around the necessity of a project', as requested by the ECNT.	This EP is not required to outline the necessity or justification of the DPD Project. No updates or additional controls required.

Greenpeace Australia Pacific

Summary of consultation effort:

- On 9 November 2023 Santos emailed Greenpeace to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Greenpeace emailed Santos to acknowledge receipt of the email. [Con-3247]
- On 22 November 2023 Santos emailed Greenpeace further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone discussion with Greenpeace which confirmed that Santos' emails had been received and forwarded to a campaign manager. Santos provided a follow-up email on 21 December 2024 confirming the telephone discussion [Con-2939]
- On 31 May 2024, Santos sent a final reminder to Greenpeace asking that it provide any feedback by 7 June 2024. [Con-4202]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Greenpeace.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Greenpeace.	Nil	Nil	Nil

Keep Top End Coasts Healthy

Summary of consultation effort:

- On 9 November 2023 Santos emailed Keep Top End Coasts Healthy to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Keep Top End Coasts Healthy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 15 December 2023 Santos followed up the previous emails by phone and left a message.
- On 20 December 2023 Santos followed up the phone call with another email to Keep Top End Coasts Healthy requesting any feedback by 22 December 2023. [Con-2940]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Keep Top End Coasts Healthy.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Keep Top End Coasts Healthy.	Nil	Nil	Nil

Landcare NT (member of Darwin Harbour Advisory Committee)

Summary of consultation effort:

- On 9 November 2023 Santos emailed Landcare NT's representative on the Darwin Harbour Advisory Committee to advise them of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and

  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Landcare NT's representative on the Darwin Harbour Advisory Committee further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos had a telephone discussion with Landcare NT which advised a new email address for communications. Santos followed-up with an email the same day re-attaching the 22 November 2023 email. [Con-2941]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Landcare NT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Landcare NT.	Nil	Nil	Nil

Sea Turtle Foundation

Summary of consultation effort:

- On 9 November 2023 Santos emailed Sea Turtle Foundation to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Sea Turtle Foundation further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos phoned Sea Turtle Foundation to follow up on previous emails and remind it of the deadline for feedback. On 20 December 2023 Santos emailed Sea Turtle Foundation to confirm the phone call. [Con-3003]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Sea Turtle Foundation.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Sea Turtle Foundation.	Nil	Nil	Nil

Territory Natural Resource Management (Territory NRM) (member of Darwin Harbour Advisory Committee)

Summary of consultation effort:

- On 9 November 2023 Santos emailed Territory NRM's representative on the Darwin Harbour Advisory Committee to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Territory NRM's representative on the Darwin Harbour Advisory Committee further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos phoned Territory NRM to follow up on previous emails and left a message about the consultation Santos was conducting on the DPD Project. On 20 December 2023 Santos emailed Territory NRM to confirm the phone call. [Con-3002]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Territory NRM.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Territory NRM.	Nil	Nil	Nil

Wilderness Society

Summary of consultation effort:

- On 9 November 2023 Santos emailed the Wilderness Society to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed the Wilderness Society further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 the Wilderness Society responded to Santos via email stating that it will not be providing input at this time. The Wilderness Society stated it would like to be kept updated as the proposal progresses and may provide input at a later time. [Con-3022]
- On 22 March 2024 Santos emailed the Wilderness Society and provided further opportunity to provide input by 28 March 2024 to the development of this EP. [Con-3530]
- Santos notes that the Wilderness Society is provided regular updates on the Barossa Project, including progress of the DPD Project, through quarterly updates.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the Wilderness Society.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by the Wilderness Society.	Nil	Nil	Nil

World Wildlife Fund (WWF)

Summary of consultation effort:

- On 9 November 2023 Santos emailed WWF to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 WWF emailed Santos to acknowledge receipt of the email. [Con-3241]
- On 22 November 2023 Santos emailed WWF further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 November 2023 WWF emailed Santos to acknowledge receipt of the email. [Con-3250]
- On 14 December 2023 Santos phoned WWF to follow up on previous emails and left a message about the consultation Santos was conducting on the DPD Project. Santos emailed WWF on 20 December 2023 to confirm the phone call. [Con-3001]
- On 21 December 2023 WWF responded to Santos via email stating the information had been passed onto its team for review and action. [Con-3322]
- On 31 May 2024, Santos sent a final reminder to WWF asking that it provide any feedback by 7 June 2024. [Con-4203]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from WWF.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by WWF.	Nil	Nil	Nil

First Nations People and groups: Representative organisations – Northern Territory

Larrakia Nation Aboriginal Corporation (LNAC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed LNAC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Santos sent an additional email to LNAC advising that Santos would be happy to meet with LNAC to discuss the information, suggested a potential week for a meeting and provided additional telephone contact details. [Con-3288]
- On 28 November 2023 Santos emailed LNAC further to the previous correspondence, to advise that it had commenced the consultation phase. Santos asked LNAC whether it would like to receive a consultation briefing/information session. Santos also stated it was keen for this information to be shared to all Larrakia families and set up drop-in session for them.. [Con-3258]
- On 8 December 2023 LNAC emailed Santos with the LNAC Board's recommended approach to consultation: [Con-3323]
  - Santos undertake Face to Face consultation on 19 December 2023. Venue and time TBC.
  - Santos advertise in the NT News the face-to-face consultation once venue and time is confirmed.
  - Larrakia Nation promote face-to-face consultation on social media including opportunity to provide feedback through Santos' toll-free number on 1800 267 600.
  - Larakia Nation email all LNAC staff to ensure they are aware of the consultation session to be conducted.
- On 12 December 2023 Santos emailed LNAC seeking to confirm the date and location for the consultation session. [Con-3324]
- As advised by LNAC, Santos organised two consultation sessions to be held in Darwin on 19 December 2023 and no Larrakia people attended the sessions. The sessions were advertised in the NT News and held during the day and at a location outside the city centre (Nightcliff Community Centre), as suggested by LNAC.
- LNAC has not provided any objections or claims through any of the channels provided in accordance with the advice from the LNAC Board.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the LNAC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by LNAC.	Nil	Nil	Nil.

Northern Land Council (NLC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed NLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3285]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.

- In the email Santos also advised that the information had been provided to a range of indigenous organisations, including the Aboriginal Sea Corporation and the Kenbi Rangers which are both affiliated with the NLC.
- On 10 November 2023 the NLC emailed Santos in response to a request from Santos for further contact details for the Aboriginal Sea Company and the Kenbi Rangers organisations, both of which were copied in the email. The NLC's CEO stated he had also forwarded Santos' information to relevant NLC senior managers. [Con-3325]
- On 10 November 2023 Santos responded to the NLC's email of 10 November 2023 advising that Santos would make sure the information was provided to both organisations and thanked the NLC for its assistance in providing contacts. [Con-3291]
- On 28 November 2023 Santos emailed NLC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023.Santos asked the NLC whether it would like to receive a consultation briefing/information session. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3257]
- During the consultation period for this EP, Santos also consulted with 6 First Nations Consultative Committees (FNCC) and/or Clan Groups representing the interests of First Nations people in coastal areas of the NLC regions of West Arnhem, Darwin/Daly/Wagait and Victoria River District. See the separate entries in this table for the outcomes of consultation with each FNCC/Clan Group.
- On 31 January 2024 the NLC also received the Barossa Development Quarterly Update which included advice on consultation and preparation of this EP and DPD Offshore CEMP. [Con-4692]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the NLC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by the NLC.	Nil	Nil	Nil.

Tiwi Land Council (TLC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed the TLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 15 November 2023 Santos emailed the TLC to request permission to attend the TLC meeting being held on 23 November 2023. In seeking the meeting Santos stated that one of the purposes of the request was to update the TLC on the planned consultation sessions with Tiwi clan groups prior to the sessions occurring in early December. [Con-3442] Later the same day Santos met with TLC executive staff who advised that the request to address the 23 November meeting would not be possible. It was agreed to have a regular meeting between Santos and TLC executive personnel. On 27 November 2023 Santos emailed a letter to the TLC on the meeting outcome. [Con-3443]
- On 28 November 2023 Santos emailed TLC further to the previous correspondence, to advise that it had commenced the consultation phase. Santos asked the TLC whether it would like to receive a consultation briefing/information session and advised the TLC of the consultation sessions being held on the Tiwi Islands the following week.. [Con-3259]
- On 30 November 2023 TLC executive staff emailed Santos in response to Santos' letter of 27 November 2023. The email stated that TLC staff would contact Santos with suggested dates for the first of the regular meetings. [Con-3444] The first meeting for 2024 was held on 6 February.
- During the consultation period for this EP, Santos also consulted with 8 Tiwi Clan Groups that are represented by the TLC. See the separate entries in this table for the outcomes of consultation with Tiwi Clan Groups.
- On 31 January 2024 the TLC also received the Barossa Development Quarterly Update which included advice on consultation and preparation of this EP and DPD Offshore CEMP. [Con-4692]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the TLC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by TLC.	Nil	Nil	Nil

Wickham Point Deed liaison committee

Summary of consultation effort:

- On 9 November 2023 Santos emailed the Wickham Point Deed liaison committee to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed the Wickham Point Deed liaison committee further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 28 November 2023 Santos held a consultation session with the Wickham Point Deed liaison committee. The following information related to this EP and the DPD CEMP was presented and discussed [Con-3335]:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
  - The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The activities were conducted in person and visual aids, maps, videos and animations were also to present information regarding the Activity and the project more generally.
- The majority of the consultation session was consumed by general themes/topics, including the following, which arose by way of discussion without any objections or claims being raised with respect to this EP:
  - The process of installing a pipeline.
  - The precautions that would be taken by Santos to minimise any impacts, including lighting and noise.
  - The process involved in the event of an accident and a spill needing to be cleaned-up.

  - Opportunities for Larrakia people to work on the Barossa Project.
- No objections or claims were raised by the Wickham Point Deed liaison committee at the consultation session. During the session a suggestion was made by one committee member regarding other persons to be consulted. The committee also requested that a one-page summary with information on DPD activities in Darwin Harbour be prepared and made available to members. The summary was provided at the committee's next meeting, held on 7 March [Con-4047]. Both the matters raised are addressed below.
- No further correspondence or feedback was received from the Wickham Point Deed liaison committee.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Measure/s Adopted (if applicable)
The Wickham Point Deed liaison committee requested that a one pager be prepared by Santos and provided to committee members with the information on DPD activities in Darwin Harbour and measures Santos is taking.	Santos provided the further information to the committee at its next meeting held on 7 March in the form of a fact sheet. Santos notes that the request does not relate to activities in Commonwealth waters which are the subject of this EP.	Santos has actioned this request and provided the requested fact sheet as part of its DPD pre-activity communications for Darwin Harbour. Santos ensures this group is kept regularly informed of its planned activities with a specific Barossa update provided at each group meeting. The presentation on 23 November 2023 and the information booklet provided also contains information that is applicable to activities in Darwin Harbour.	No updates or additional controls required on the basis of this feedback.
A member of the committee suggested that the Bulgal Community at Peron Islands also need to be considered for consultation on the DPD activities in NT waters and future Barossa Operations.	Santos considers that the Bulgal Community were consulted by Santos via the Rak Badjalarr Consultative Committee.	See separate entry in this table for Rak Badjalarr Consultative Committee.	N/A

First Nations People and groups: First Nations Consultative Committees and coastal clan groups - NT

Mulyurrud Consultative Committee

Summary of consultation effort:

- On 23 November 2023 Santos held a consultation session with the Mulyurrud Consultative Committee at Kakadu Crocodile Hotel, Jabiru. [Con-2950]
- The following information related to this EP and the DPD Offshore CEMP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The session was conducted in person and visual aids, maps, videos and animations were also used to present information regarding the Activity and the project more generally.
- At the session only one question was asked by Mulyurrud Consultative Committee members about the size of the pipe that would be installed. A statement made about notifications by Rangers in the event of an unplanned spill is addressed below.
- No objections or claims were raised by the Mulyurrud Consultative Committee. A statement made during the session is specifically addressed below.
- No further correspondence or feedback was received from the Mulyurrud Consultative Committee.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
A statement was made by a meeting attendee that the relevant Rangers would notify clan members if there was ever an issue with a diesel spill.	Santos acknowledges this statement.	Santos responded that spills are very unlikely to happen. Santos will notify relevant FNCCs and clan groups if there is a hydrocarbon spill that has the potential to impact their coastal areas.	Table 8-5 updated to include relevant FNCCs and clan groups notification requirement if there is a hydrocarbon spill that has the potential to impact their coastal areas. Section 7.2 of the OPEP (BAS-210 0131) also details the notification requirements: including hydrocarbon spill notification to the FNCCs and clan groups, including the Mulyurrud Consultative Committee.

Rak Badjalarr Consultative Committee

Summary of consultation effort:

- On 15 November 2023 Santos held a consultation session with the Rak Badjalarr Consultative Committee at Crab Claw Island Resort. [Con-2929]
- The following information related to this EP and the DPD Offshore CEMP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required;
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions;

  - The environmental impacts and risks involved with the planned activities; and planned controls to management those risks and
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks.
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The session was conducted in person and visual aids, maps, videos and animations were also used to present information regarding the Activity and the project more generally.
- The majority of the consultation session was consumed by general themes/topics, including the following, which arose by way of discussion without any objections or claims being raised with respect to this EP:
  - The dimensions of the pipeline that will be installed
  - The process of installing a pipeline
  - The extent of the geographical areas covered by this EP and DPD Offshore CEMP
  - How an EMBA is determined and modelled
  - The existing precautions that would be taken by Santos to minimise any impacts, including lighting and noise, on marine animals.
  - The structural integrity and strength of the pipeline during a tsunami, cyclone or natural disaster.
  - The inspection process once the pipeline has been installed
  - The process involved in the event of an accident and a spill needing to be cleaned-up and access to spill response training.
  - Support for community and ranger activities
- No objections or claims were raised by the Rak Badjalarr Consultative Committee. Some statements and requests made during the session are addressed below.
- No further correspondence or feedback was received from the Rak Badjalarr Consultative Committee.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
A request was made by one attendee that they wanted to keep details of the consultation meeting private and requested a copy of the record from the meeting. Another attendee stated they did not want the information to even "go to Canberra".	Santos noted the requests. Privacy provisions are in place and a copy of the consultation section from the meeting is provided.	Santos advised the attendees that some of the information discussed in the sessions must be shared with the regulator. A consultation summary will be included in this EP and it will be published at some point by the regulator. However, no names are included in the document. Santos explained that conversations on Sea Country that are confidential can also be kept private upon request.	N/A
Following a statement from Santos that sacred sites were important, a response from the committee member was that they had a lot of sacred sites	No specific information was provided by the Rak Badjalarr Consultative Committee on sacred sites.	Santos responded at the session that whilst many sacred sites can be viewed on a public register, not all are included. As such, Santos seeks feedback and guidance from the Committee to help manage sacred sites. Santos acknowledges the presence of sacred sites within the EMBA, including those registered with AAPA. Santos acknowledges that there are many culturally significant sites identified from the Kenbi (Cox Peninsula) Land Claim No. 37 and that the Kenbi clan is represented on the Rak Badjalarr Consultative Committee. Indigenous heritage areas of the 'Beagle Gulf – Darwin Coast', which includes the area from Cox Peninsula to Daly River, is acknowledged as sensitivity for consideration in spill response planning (Net Environmental Benefit Analysis).	A discussion of sacred sites in the EMBA is included within Section 3.2.14.6. This includes sacred sites identified in the Kenbi (Cox Peninsula) Land Claim No. 37. Indigenous heritage areas of the 'Beagle Gulf – Darwin Coast', which includes the area from Cox Peninsula to Daly River, is acknowledged as sensitivity for consideration in spill response planning (Net Environmental Benefit Analysis) as included in Section 6.6 of the OPEP (BAS-210 0131).
A statement was made that Santos is speaking to the Committee to avoid reputational risk and due to the Government's requirements.	N/A	Santos explained that consultation was important to the business and the Government, not just to tick a box.	N/A

A request was made by a clan member that they would like to be notified if there was an oil spill.	Santos responded verbally if there was a diesel spill that it would be required to notify affected stakeholders	Santos will notify relevant FNCCs and clan groups if there is a hydrocarbon spill that has the potential to impact their coastal areas	Spill notification requirements to FNCCs and clan groups, including the Rak Badjalarr Consultative Committee, are outlined in Table 8-5 and Section 7.1 of the OPEP (BAS-210 0131).

Daly River / Port Keats First Nations Consultative Committee (Daly River / Port Keats FNCC)

Summary of consultation effort:

- On 1 December 2023 Santos held a consultation session with the Daly River / Port Keats FNCC at Club Tropical Resort, Lee Point. [Con-2951]
- The following information related to this EP and the DPD Offshore CEMP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The session was conducted in person and visual aids, maps, videos and animations were also used to present information regarding the Activity and the project more generally.
- The majority of the consultation session was consumed by general themes/topics, including the following, which arose by way of discussion without any objections or claims being raised with respect to this EP:
  - The extent of the geographical areas covered by this EP and Offshore CEMP
  - The topography of the seabed where the pipeline will be installed
  - From which countries do the pipeline installation vessels originate
  - The pipeline welding process at sea
  - How Santos will communicate with prawn trawlers in the area where activities will occur
  - How an EMBA is determined and modelled
  - Precautions that will be taken by Santos during the turtle breeding season
  - Precautions that will be taken by Santos to reduce the risk of a collision between vessels
  - The notification process in the event of a hydrocarbon spill
  - Avoidance of fish protection areas (outside of the OA).
  - The structural integrity and strength of the pipeline during a tsunami, cyclone or natural disaster.
  - How actions arising from committee meetings will be managed by Santos and the Committee
  - Privacy provisions during the consultation process
- No objections or claims were raised by the Daly River / Port Keats FNCC. Some statements made during the session are addressed below.
- No further correspondence or feedback was received from the Daly River / Port Keats FNCC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
A statement was made that some senior people were not at the meeting and, subject to discussion with those people, another meeting may be required with them in attendance.	The committee decides on its representation and the nature of the consultation required. No further meeting was requested.	Santos stated it would be happy to attend another meeting if required.	N/A
Following Santos' explanation of what an EMBA is and the likely scenarios for an unplanned spill during this activity, a statement was made that a spill "wouldn't affect the coastline because of the weather".	N/A	Santos responded that the EMBA is based on computer simulations representing a large accident, which is very unlikely. The model also shows the impact if Santos did not do anything at all in response and is therefore very conservative.	Section 3.1.1 explains the spill modelling that has been used to determine the EMBA. A further description of the spill modelling is provided in the impact and risk assessment (Section 7.6) and within the Section 6 of the OPEP (BAS-210 0131).

Wulna clan

Summary of consultation effort:

- On 13 December 2023 Santos held a consultation session with the Wulna Clan at Windows on the Wetlands, Arnhem Highway. [Con-2966]
- The following information related to this DPD EP and the DPD Offshore CEMP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks

- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The session was conducted in person and visual aids, maps, videos and animations were also used to present information regarding the Activity and the project more generally.
- The majority of the consultation session was consumed by general themes/topics, including the following, which arose by way of discussion without any objections or claims being raised with respect to this EP:
  - Where vessels are sourced from and what biosecurity precautions involved
  - Potential light and noise impacts from helicopters flying at night
  - The notification process in the event of a hydrocarbon spill and access to spill response training
- No objections or claims were raised by the Wulna Clan however a request around spill notifications is included below.
- No further correspondence or feedback was received from the Wulna Clan.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
A query was made from a clan member if Santos would contact the Land Council and relevant First Nations communities if there was a diesel spill.	Santos responded verbally if there was a diesel spill that it would be required to notify affected stakeholders.	Santos will notify the Northern Land Council and relevant FNCCs and clan groups if there is a hydrocarbon spill that has the potential to impact their coastal areas.	Spill notification requirements to FNCCs and clan groups, including the NLC and Wulna Clan, are outlined in Table 8-5 and Section 7.1 of OPEP (BAS-210 0131).

Agalda clan

Summary of consultation effort:

- On 21, 22 and 23 November 2023 Santos held consultation sessions with the Agalda clan at the Kakadu Crocodile Hotel, Jabiru. [Con-2948], [Con-2949].
- The following information related to this EP and the DPD Offshore CEMP was presented and discussed:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the consultation session.
- The session was conducted in person and visual aids, maps, videos and animations were also used to present information regarding the Activity and the project more generally.
- During the consultation session, questions of a general nature were asked about the pipeline installation process, e.g. how pipeline sections are welded together, how the EMBA for DPD activities was prepared and the involvement of other bodies in Santos' research activities.
- No objections or claims were raised by the Agalda Clan. One concern related to sacred sites was raised and is addressed below along with a request also made at the session.
- No further correspondence or feedback was received from the Agalda Clan

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Concern was expressed about the sacred sites around the west and south of Coburg and Croker Island and the statement made that all sites have been registered with AAPA.	Santos is aware that many scared sites are registered with AAPA and will ensure any additional information provided through the Agalda Clan's identified committee is assessed. No further detail was provided in this instance.	Santos has taken this feedback into account.	Section 3.2.14.6 acknowledges that there are sacred sites, including those registered with AAPA, within the EMBA. Additional text has been added to specifically recognise that there are sacred sites to the west and south of Coburg and Croker Island. Spill notification to the Algada clan is outlined in Table 8-5 and Section 7.1 of the OPEP (BAS-210 0131). Indigenous heritage areas of the Coburg Peninsula is acknowledged as sensitivity for consideration in spill response planning (Net Environmental Benefit Analysis) as included in Section 6.6 of the OPEP (BAS-210 0131).
A request was made to notify the Clan in the event of a hydrocarbon spill.	Santos confirmed that this would be done.	Santos will notify relevant FNCCs and clan groups if there is a hydrocarbon spill that has the potential to impact their coastal areas.	Spill notification requirements to FNCCs and clan groups, including the Algada Clan, are outlined in Table 8-5 and Section 7.1 of the OPEP (BAS-210 0131). Indigenous heritage areas of the Coburg Peninsula are acknowledged as sensitivities for consideration in spill response planning (Net Environmental Benefit Analysis) as included in Section 6.6 of the OPEP (BAS-210 0131).

Larrakia People

Summary of consultation effort:

- In order to assist with its efforts to reach out to Larrakia people in a culturally sensitive and appropriate way, consistent with NOPSEMA's consultation guidelines (2023, 2024), Santos requested advice and assistance from LNAC, which speaks on behalf of Larrakia people, in relation to appropriate ways to engage with Larrakia people. This was additional to Santos' consultation with LNAC in its own right (see the separate entry for LNAC in this Table 4-10).
- On 28 November 2023, Santos emailed LNAC to advise that it had commenced the consultation phase. Santos stated it was keen for information to be shared to all Larrakia families and to set up a drop-in session for them. [Con-3258]
- On 8 December 2023, LNAC emailed Santos with the LNAC Board's recommended approach to consultation with Larrakia people: [Con-3323]

- Santos undertake face-to-face consultation on 19 December 2023. Venue and time TBC.
- Santos advertise in the NT News the face-to face consultation once venue and time is confirmed.
- Larrakia Nation promote face-to-face consultation on social media including opportunity to provide feedback through Santos' toll-free number on 1800 267 600.
- Larrakia Nation email all LNAC staff to ensure they are aware of the consultation session to be conducted.

- On 12 December 2023, Santos emailed LNAC seeking to confirm the date and location for the consultation session. [Con-3324]
- On 19 December 2023, Santos held two consultation sessions for Larrakia people in Darwin and no Larrakia people attended the sessions. The sessions were advertised in the NT News and held during the day and at a location outside the city centre (Nightcliff Community Centre). The means of advertising and the location and date were all selected in accordance with LNAC's advice. Prior to the sessions, LNAC also advised Santos that it would use its own lines of communication to further disseminate information about the consultation sessions to Larrakia people. [Con-3323]
- On 12 June 2024, Santos held two consultation sessions in Darwin to close-out consultation on DPD activities with Larrakia people. [Con-4264] [Con-4263]
- In addition to the consultation efforts described above, Larrakia families are also represented on the Wickham Point Deed liaison committee, which has been separately consulted in relation to this EP – see the separate entry for the liaison committee in this Table 4-10. The DPD Project has been a regular agenda item at quarterly Wickham Point Deed liaison committee meetings since November 2021. As per the entry in this table for the liaison committee, consultation with respect to activities within this EP was held on 28 November 2023.

Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Larrakia People.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised at the consultation sessions.	Nil	Nil	Nil

First Nations People and groups: Representative organisations – Northern Territory

Aboriginal Sea Company (ASC)

Summary of consultation effort:

- On 13 November 2023 Santos emailed the Aboriginal Sea Company (ASC) to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3292]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023In the email Santos also advised that it would be in contact again to seek ASC's feedback and provided additional telephone contact details.
- On 16 November 2023 Santos made an attempt to contact the ASC by phone to determine whether ASC would like to discuss the information that had been provided.
- On 22 November 2023 Santos emailed ASC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 and 15 December 2023 Santos made further attempts to contact the ASC by phone to remind it of the deadline for feedback.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from ASC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by ASC.	Nil	Nil	Nil

Gwalwa Daraniki Association (GDA)

Summary of consultation effort:

- On 15 November 2023 Santos emailed the Gwalwa Daraniki Association (GDA) to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3295]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 16 and 20 November 2023 Santos made attempts to contact the GDA by phone to determine whether GDA would like to discuss the information that had been provided.
- On 22 November 2023 Santos emailed GDA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 and 18 December 2023 Santos made further attempts to contact the GDA by phone to remind it of the deadline for feedback.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from GDA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by GDA.	Nil	Nil	Nil

Kenbi Rangers

Summary of consultation effort:

- On 13 November 2023 Santos emailed Kenbi Rangers to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3293]

- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos also advised that it would be in contact again to seek Kenbi Rangers' feedback and provided additional telephone contact details.
- On 16 and 20 November 2023 Santos made attempts to contact the Kenbi Rangers by phone to determine whether Kenbi Rangers would like to discuss the information that had been provided.
- On 22 November 2023 Santos emailed Kenbi Rangers further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 18 December 2023 Santos made a further attempt to contact the Kenbi Rangers by phone to remind it of the deadline for feedback.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Kenbi Rangers.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Kenbi Rangers.	Nil	Nil	Nil

Larrakia Development Corporation (LDC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed the Larrakia Development Corporation (LDC) to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Santos sent an additional email to LDC advising that Santos would be happy to meet with LDC to discuss the information, suggested a potential week for a meeting and provided additional telephone contact details. [Con-3289]
- On 16 and 20 November 2023 Santos made attempts to contact the LDC by phone to determine whether LDC would like to discuss the information that had been provided.
- On 22 November 2023 Santos emailed the LDC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 31 January 2024 LDC also received the Barossa Development Quarterly Update which included advice on consultation and preparation of this EP and DPD Offshore CEMP. [Con-4692]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from LDC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by LDC.	Nil	Nil	Nil

North Australia Indigenous Land and Sea Management Alliance (NAILSMA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed the North Australia Indigenous Land and Sea Management Alliance (NAILSMA) to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Santos sent an additional email to NAILSMA advising that Santos would be happy to meet with NAILSMA to discuss the information, suggested a potential week for a meeting and provided additional telephone contact details. [Con-3290]
- On 15 and 20 November 2023 Santos made attempts to contact NAILSMA by phone to determine whether NAILSMA would like to discuss the information that had been provided.
- On 22 November 2023 Santos emailed NAILSMA further to previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NAILSMA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NAILSMA.	Nil	Nil	Nil

Tiwi Islands Clan Groups and Individuals

Summary of consultation effort:

- Santos continued its staged approach to consultation with Tiwi Islands clan groups and individuals.
- Consultation activities were conducted in person at 3 locations on the Tiwi Islands, primarily through discussions or presentations.
- The sessions were advertised in advance in accordance with a process agreed with the Clan groups.

- At the sessions Santos used visual aids, maps, videos, animations to present information regarding the Activity and the project more generally.
- The presentation also covered the regulatory consultation processes and privacy provisions and provided an overview of Santos the company and the Barossa Project overall.
- The information booklet and NOPSEMA consultation brochure were also provided at the sessions.
- The following consultation sessions were held on the Tiwi Islands noting that for the sessions, regardless of location and notice sent out for specified clans, representatives from other clans were permitted to, and did, attend meetings as set out in the relevant meeting minutes:
  - On 5 December 2023 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapati (Social and Sports Club). [Con-2952]
  - On 6 December 2023 with the Jikilaruwu and Mantiyupwu Clans at Wurrumiyanga (Nguiu Club). [Con-2960], [Con-2963]
  - On 7 December 2023 with the Wurankuwu and Malawu Clans at Wurrumiyanga (Mantiyupwi Meeting Room) [Con-2964], [Con-2965]
  - On 30 January 2024 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapati (Sports and Recreation Centre). [Con-3349]
  - On 31 January 2024 with the Jikilaruwu and Mantiyupwu Clans at Wurrumiyanga (Mantiyupki Motel). [Con-3350], [Con-3351]
  - On 1 February 2024 with the Wurankuwu and Malawu Clans at Wurrumiyanga (Mantiyupki Motel). [Con-3352], [Con-3353]
  - On 2 February 2024 with the Munupi Clan at Pirlangimpi (Sports and Social Club). [Con-3109]
  - On 5 March 2024 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapati (Sports and Recreation Centre). [Con-4160]
  - On 6 March 2024 with the Jikilaruwu and Mantiyupwu Clans at Wurrumiyanga (Mantiyupwi Motel). [Con-4161] [Con-4162]
  - On 7 March 2024 with the Wurankuwu and Malawu Clans at Wurrumiyanga (Mantiyupwi Motel). [Con-4163] [Con-4164]
  - On 8 April 2024 with the Munupi Clan at Pirlangimpi (Sports and Social Club). [Con-4093]
  - On 9 April 2024 with the Marrikawuyanga, Yimpinari and Wulirankuwu Clans at Milikapati (Social and Sports Club). [Con-4095]
  - On 10 April 2024 with the Jikilaruwu and Mantiyupwu Clans at Wurrumiyanga (Mantiyupwi Motel). [Con-4096], [Con-4097]
  - On 17 May 2024 with the Manupi Clan at Pirlangimpi (Sports and Social Club). [Con-4231]

  Note: 2 consultation sessions with the Munupi Clan planned for 8 December 2023 and 8 March 2024 were cancelled due to sorry business.
- In addition to the sessions held on the Tiwi Islands, the following sessions were also held in Darwin:
  - On 14 December 2023 with Tiwi Islands people (Mantiyupwi and Murrumujuk clans) with interests in the Vernon Islands. [Con-2967]
  - On 29 January 2024 for any Darwin-based Tiwi Peoples. [Con-3348]
  - On 22 March 2024 for any Darwin-based Tiwi Peoples. [Con-4844]
- The following information related to this EP and the DPD Offshore CEMP was presented and discussed at each Tiwi consultation session:
  - The Commonwealth Government and NT Government regulations and approvals required
  - The activities covered by this EP and the DPD Offshore CEMP, including installation steps and vessel descriptions
  - The environmental impacts and risks involved with the planned activities and planned controls to management those risks
  - The EMBA in the event of an unplanned event, the risks and planned controls to management those risks
  - The majority of the first 2 consultation sessions was consumed by general themes/topics, including the following, which arose by way of discussion without any objections or claims being raised with respect to this EP:
  - the pipeline installation process
  - how Santos would prevent/contain a leak in the pipeline;
  - the safety and maintenance of pipelines once installed
  - the impact of cyclones and other weather events on the infrastructure;
  - management of general waste at sea
  - how the light on vessels may affect turtles hatching and the impact of marine life generally;
  - the risk of spills or explosions and the location of condensate spill kits;
  - vessel collisions and vessel activities around Darwin (and the impact of the pipeline on the same);
  - the environmental impact of the project generally and to the marine life;
  - the pre-activity notification process
  - job opportunities and other benefits for Tiwi Islanders;
  - the involvement of the land rangers as part of the response to a spill.
- A number of the questions raised at these sessions related to activities covered by other EPs (being the D&C, SURF and GEP EPs) that had also been raised and discussed at previous consultation sessions.
- Across all the sessions there were a number of issues raised in the form of either concerns or specific requests, which are addressed below.
- No further correspondence or feedback was received from Tiwi clans.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Statement that Santos needs to be laying the pipeline flat	Santos acknowledged the feedback and responded verbally within the consultation session.	Santos responded that it undertakes surveys of the seabed to ensure the seabed along the route is as flat as possible and will undertake pre-lay span rectification if required to ensure the pipeline will lay flat with pipeline spanning minimized.	Pre-lay span rectification is detailed in Section 2.5.3.2.

A suggestion that no lifting should occur during the DPD activity	Santos acknowledged the feedback and responded verbally within the consultation session.	Lifting operations are unavoidable but Santos implements a range of control measures to prevent dropped objects including lifting procedures and equipment certification. Santos adopts no lifting zones to avoid live infrastructure.	Dropped objects is acknowledged as a risk in Section 7.1 and control measures and performance standards that will be implemented to reduce impacts and risks are listed in Table 8-2.
Broad concerns about how the activity could impact the islands (Tiwi Islands), and sea and seabed offshore from the islands	Santos provided information during the consultation sessions outlining all impacts and risks associated with the Project that could impact the sea and in the case of a hydrocarbon spill, the Tiwi Islands.	Santos outlined the impacts and risks associated with the activity and the control measures it would be following to reduce the level of impact or risk.	Details of impacts and risks are provided in Sections 6 and 7 and control measures and performance standards that will be implemented to reduce impacts and risks are provided in Table 8-2.
Concerns around the potential for leaks from the DPD pipeline from dropped objects (anchors, shipping containers), natural weather events (strong currents, rough seas, tidal waves and earthquakes) and large megafauna (sharks and crocodiles)	Santos acknowledged the feedback around risks associated with the pipeline once laid and responded verbally in the consultation session. Santos notes that these risks are more relevant to the DPD pipeline once operational rather than construction activities covered under this EP.	Santos stated that design of the pipeline is sufficient to withstand impacts including the thickness of the steel and the concrete weighting. Santos explained that maps will show other users where the pipeline is.	Detail of pipeline construction is included in Section 2.5.4.The marking of the pipeline on nautical charts to alert other marine users of its presence is included as a control measure (C6.1.2), with associated performance standard, in Table 8-2.
Clan member asked if the pipeline could be built further away	Santos acknowledged the feedback and responded verbally in the consultation session.	Santos replied that the Barossa Gas Export Pipeline (GEP) route has been approved and construction commenced. The DPD pipeline will connect to the Barossa GEP.	N/A
Concerns about pipeline leakage and impacts to fishing	Santos acknowledged the feedback and responded verbally in the consultation session. Santos notes that these risks are more relevant to the DPD pipeline once operational rather than construction activities covered under this EP.	Santos replied that the pipelines are designed not to leak and will be tested (pigging) to ensure it is good condition (thickness and condition of welds) during operations.	Detail of pipeline construction is included in Section 2.5.4. Detail of pipeline testing is included in Section 2.6. Commercial and recreational fishing within the OA is detailed in Section 3.2.13.1 and Section 3.2.13.6. The impact assessment provided in Section 6.1.
Concerns about vessel cooling water being discharged to the sea	Santos acknowledged the feedback and responded verbally in the consultation session.	Santos outlined the impacts and control measures associated with permitted vessel discharges, including cooling water.	Detail on the impact of vessel discharges is included in Section 6.6 and the control measures and performance standards that will be implemented to manage vessel discharges are included in Section 6.6.3 and Table 8-2.
Clan members requested further information about chemicals to be used during testing of the pipeline.	Santos acknowledged the feedback and provided additional information in subsequent clan sessions.	Santos agreed to provide some more information on chemicals. Further information was provided in subsequent clan meetings including details on the types of chemicals, the appearance of the chemicals, and the concentrations of the chemicals used.	Detail of chemicals used in pipeline testing is included in Sections 2.6 and 2.11.
Request made not to touch the Bayu-Undan pipeline when undertaking DPD Project	Santos acknowledged the feedback and responded verbally in the consultation session.	Santos explained there were rules in place for working around the Bayu-Undan pipeline including lifting procedure and certified equipment.	The potential for damage to the Bayu-Undan pipeline and resultant gas release is included as a risk in Section 7.8 with control measures and associated performance standards (Table 8-2).
Statement made that there were lots of trawlers and a concern if they would be aware of the pipeline	Santos acknowledged the potential interaction between trawlers and the DPD pipeline and responded verbally in the consultation session.	Santos explained that other vessels would be made aware of the construction work and that the pipeline would be marked on nautical charts.	Commercial fishing within the OA is detailed in Section 3.2.13.1 and the impact assessment provided in Section 6.1.The marking of the DPD on nautical charts to alert other marine users of its presence is included as a control measure (C6.1.2), with associated performance standard, in Table 8-2.

	Santos notes that these risks are more relevant to the DPD pipeline once operational rather than construction activities covered under this EP.		
A concern that, in the event of a diesel spill, diesel would go 'everywhere' and remain in the water 'forever'.	Santos provided feedback in the session around the worst-case credible diesel spill scenario and where such a spill could go. Santos does not agree that a spill would go everywhere and last forever. Diesel spilt to the ocean undergoes weathering processes that reduce its volume and concentration over time with any residual fraction following initial weathering biodegrading.	Santos provided information on the worst-case credible diesel spill associated with DPD Project and the spill modelling that had been undertaken to define where a worst-case spill could go (i.e. the EMBA). Santos explained that diesel spills do not go everywhere at once but would move depending upon the wind and currents and that they would become less concentrated as they move away from the spill source. Santos explained that spills would be responded to as per spill response plans and supporting arrangements.	Detail on the worst-case credible diesel spill modelling is provided in Section 3.1.1 (in terms of defining the EMBA) and impacts associated with credible diesel spills are detailed in Section 7.6. Santos' spill response arrangements are outlined within the OPEP (BAS-210 0131).
Statement made that if there was a diesel spill Santos would need someone there on the ground.	Santos acknowledged the feedback and responded verbally in the consultation session.	Detail on the control measures and performance standards that will be implemented to avoid and mitigate diesel spills is provided in Section 7.6.3 and Table 8-2.	The control measures and performance standards that will be implemented to avoid and mitigate diesel spills is provided in Section 7.6.3 and Table 8-2. Santos' spill response arrangements are outlined within the OPEP (BAS-210 0131) and notifications are listed in Table 8-5.
Request that the Sea Rangers are engaged with the Project.	Santos acknowledged the request and responded verbally in the consultation session.	Santos explained there were many spill response arrangements in place that would be activated, including mobilisation of people to a spill site.	The role of the Tiwi Island Ranger group in spill response rapid assessment is outlined in Section 5.4.2 of the OPEP (BAS-210 0131).
Concern that TLC was not notified of Santos activities.	Santos acknowledged the request and responded verbally in the consultation session that this will occur.	Santos confirmed that activity notification list will include the TLC.	TLC has been added to the notification list for start of activities notifications in Table 8-5.
Concern raised that the lighting of Project vessels could impact important turtle nesting and seagulls at Seagull Island.	Santos acknowledged the concern and responded verbally in the consultation session.	Santos explained that the DPD activity is at its closest 27 km away from south-west of Tiwi Islands and Seagull Island is >100 km away from the closest part of the OA. At this distance vessel lighting will not have an effect on nesting and turtle hatchling at Seagull Island based on modelling of light spill conducted, nor will it affect seagulls at this distance.	The potential impact on turtles and birds from vessel light spill is included in Section 6.4, which includes further detail on light spill modelling conducted.
Tiwi Islander clan members asked whether a seabed survey could be shared.	Santos acknowledged the feedback and provided additional information in subsequent clan sessions.	Santos responded that it would come back with further information. Santos returned with typical images of the seabed off the Tiwi coast and stated that it typically didn't share full survey information.	Seabed survey information of the DPD pipeline route is provided in Section 3.2.8.
Tiwi Islander clan members asked whether a copy of the activity impacts table presented at the meetings could be shared.	Santos acknowledged the feedback and provided additional information in subsequent clan sessions.	Santos agreed to provide a copy of activity impacts table and provided hardcopy printouts of the table in a subsequent session.	Planned activities impact assessment and associated control measures are detailed in Section 6 and Table 8-2.

Tiwi Islander clan members asked whether cultural heritage monitors onboard vessels could provide feedback directly to Tiwi People at the end of their shift.	Santos acknowledged the feedback verbally and has conducted a subsequent session with a Tiwi Island cultural heritage monitor.	Santos agreed that the request was a good idea. Santos has undertaken subsequent consultation with the aid of a Tiwi cultural heritage monitor.	N/A
At the 14 December 2023 session with Tiwi Islands people (Mantiyupwi clan) with interests in the Vernon Islands, a statement was made that sea rangers would work with Santos in the event of a spill and a question was posed about whether more volunteers would be needed to assist.	Santos responded to the question verbally at the session.	Santos explained that when it prepares an EP it also submits a separate plan (an OPEP) for responding to an unplanned hydrocarbon spill. The OPEP includes arrangements for working with other organisations or groups. This includes the Tiwi Rangers who have been trained on some spill response measures. Santos also explained that there have been occasions where there have been community volunteers also used to assist with coastal clean-up in particular, under the supervision of trained people. This could also happen if required.	Santos management strategy for preventing and mitigating diesel spills is outlined within Section 7.7.5 of the OPEP (BAS-210 0131) and control measures are listed in Section 7.6.3 with performance standards included in Table 8-2. The role of the Tiwi Island Ranger group in spill response rapid assessment is outlined in Section 5.4.2 of the OPEP (BAS-210 0131

First Nations People and groups: Representative organisations – Western Australia

Kimberley Land Council (KLC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed KLC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3283]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos advised that it would contact the KLC again when the consultation period commenced but would be happy to meet with the KLC earlier. Santos also advised that the information had also been provided to the Northern Land Council and Tiwi Land Council.
- On 9 November 2023 Santos emailed the KLC separately in relation to the consultation process for all Santos EPs, including Barossa EPs, stating Santos' understanding of the KLC's current position and Santos' efforts to develop a consultative committee model. [Con-2648]
- On 22 November 2023 Santos emailed KLC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 and 20 December 2023 Santos followed-up the previous emails with phone calls to KLC.
- On 31 January 2024 the KLC also received the Barossa Development Quarterly Update which included advice on consultation and preparation of this EP and DPD Offshore CEMP.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the KLC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by KLC.	Nil	Nil	Nil

Industry Associations – Commercial Fishing

Australian Southern Bluefin Tuna Industry Association (ASBTIA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed ASBTIA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed ASBTIA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]

- Santos followed-up the previous emails with a phone call to ASBTIA on 14 December 2023 and a follow-up email on 20 December 2023 [Con-3000]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from the ASBTIA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by ASBTIA.	Nil	Nil	Nil

Commonwealth Fisheries Association (CFA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed CFA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed CFA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Santos followed-up the previous emails with a phone call to CFA on 14 December 2023 and a follow-up email on 20 December 2023 [Con-2999]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP From the CFA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by CFA.	Nil	Nil	Nil

Northern Territory Seafood Council (NTSC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed NTSC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3279]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos also asked if NTSC would be able to meet during November to discuss the information. Santos also advised that the information would also be posted to NT licence holders the following day.
- On 15 November 2023 Santos attempted to contact the NTSC via phone.
- On 22 November 2023 Santos emailed NTSC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Santos followed-up the previous emails with a phone call to NTSC on 14 December 2023 and a follow-up email on 20 December 2023 [Con-3016]
- On 21 December 2023 NTSC responded to Santos via email stating that the information had been provided to the Chair of its Offshore Net and Line Committee and, if Santos did not hear directly from the Chair, there will be no other submission or feedback from NTSC. [Con-3300]
- On 9 January 2024 Santos emailed the NT Seafood Council (NTSC) to advise it of the correspondence with one of its Licence Holders, a potential meeting with the Licence-Holder and whether the NTSC and any other person would like to be involved. [Con-3316]
- On 19 January 2024 Santos unsuccessfully attempted to contact the Licence-Holder by phone to gain further information and arrange a meeting.
- On 22 March 2024 Santos again emailed the Licence-Holder who had expressed concern about the activities and provided further opportunity to provide input by 28 March 2024 to the development of this EP. The email was again copied to the NTSC. [Con-3532]. No response was received.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NTSC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NTSC.	Nil	Nil	Nil

Northern Prawn Fishing Industry (NPFI) Limited

Summary of consultation effort:

- Formal consultation with NPF Licence Holders occurs via their representative association, the Northern Prawn Fishing Industry (NPFI) Ltd (see separate NPFI entry). This is the process requested by the NPFI and licence-holders.
- On 9 November 2023 Santos emailed NPFI to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3280]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos also asked if NPFI would be able to meet later in the month to discuss the information.

- On 15 November 2023 Santos attempted to contact the NPFI via phone.
- On 22 November 2023 Santos emailed NPFI further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NPFI.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NPFI.	Nil	Nil	Nil

Western Australian Fishing Industry Council (WAFIC)

Summary of consultation effort:

- On 9 November 2023 Santos emailed WAFIC to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed WAFIC further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone discussion during which WAFIC stated it did not need to be consulted given the location of DPD activities. Santos followed up with an email to WAFIC confirming the phone discussion. [Con-3017]
- On 21 December 2023 WAFIC responded to Santos via email re-stating that WAFIC had developed a preferred approach in undertaking consultation with commercial fishing licence holders (from WA State fisheries) that will only be affected by a significant unplanned event, to manage consultation fatigue. [Con-3299]
- No further correspondence or feedback was received from WAFIC.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
WAFIC referred Santos to its preferred approach in undertaking consultation with commercial fishing licence holders (from WA State fisheries) that will only be affected by a significant unplanned event.	Santos acknowledges that WAFIC's stated approach does not require consultation for the activities proposed under this EP.	Santos confirmed the approach with WAFIC.	Nil

Industry associations – Recreational fishing

Amateur Fishermen's Association of the Northern Territory (AFANT)

Summary of consultation effort:

- On 9 November 2023 Santos emailed AFANT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed AFANT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos phoned AFANT to follow up on previous emails and seek any feedback on the proposal, and emailed to confirm the call on 20 December 2023 [Con-3008].
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from AFANT

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by AFANT.	Nil	Nil	Nil

Industry associations – Tourism

Northern Territory Guided Fishing Industry Association (NTGFIA)

Summary of consultation effort:

- On 9 November 2023 Santos emailed NTGFIA to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NTGFIA further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]

- Santos followed-up the previous emails with a phone call to NTGFIA on 14 December 2023 and a follow-up email on 20 December 2023 [Con-2953]
- •Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NTGFIA.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NTGIFA.	Nil	Nil	Nil

Tourism Top End

Summary of consultation effort:

- On 9 November 2023 Santos emailed Tourism Top End to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3282]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- In the email Santos advised Tourism Top End that it would be happy to arrange a meeting to discuss the information.
- On 22 November 2023 Santos emailed Tourism Top End further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos had a phone discussion with Tourism Top End during which Tourism Top End advised the emails had been provided to the appropriate person.
- On 20 December 2023 Santos followed-up with an email to Tourism Top End reminding it of the 22 December deadline for feedback or comments. [Con-2954]
- •Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from. Tourism Top End.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Tourism Top End.	Nil	Nil	Nil

Industry associations - Local industry

Chamber of Commerce Northern Territory (CCNT)

Summary of consultation effort:

- On 9 November 2023 Santos emailed CCNT to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed CCNT further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone discussion with CCNT and a follow-up email on 20 December 2023. [Con-3009]
- On 21 December 2023 CCNT responded to Santos via email stating that it had decided not to participate in this EP consultation. [Con-3326]
- No further feedback or correspondence was received from CCNT.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by CCNT.	Nil	Nil	Nil

Infrastructure Operators

BW Digital

Summary of consultation effort:

- On 9 November 2023 Santos emailed BW Digital to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed BW Digital further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Santos followed-up the previous emails with a phone discussion with BW Digital on 18 December 2023 and follow-up email on 19 December 2023 [Con-3004]
- On 19 December 2023, BW Digital emailed Santos to advise that it considered itself to be a relevant person and that it expected to operate vessels in the proposed work area in a similar timeframe to the proposed DPD Project activities. BW Digital noted that it expected Santos' 500m exclusion zone to be sufficient for the safe operation of BW Digital's vessels and requested that Santos maintain contact with BW Digital to ensure that the parties' respective activities were appropriately co-ordinated. [Con-3427]

- On 20 December 2023 BW Digital emailed Santos to provide contact details for ongoing communications on operational matters [Con-3004].
- No further feedback or correspondence was received from BW Digital.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
BW Digital advised that it expected to operate vessels in the proposed work area in a similar timeframe to the proposed DPD Project activities and requested that Santos maintain contact with BW Digital to ensure that the parties' respective activities were appropriately co-ordinated	Santos notes BW Digital's advice that it expects Santos' 500m exclusion zone will be sufficient for the safe operation of BW Digital's vessels	Santos is in regular contact with BW Digital	Control measures and associated performance standards relevant to other marine user interactions are provided in Table 8 5.

Darwin Port

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Port to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Port further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos had a phone discussion with Darwin Port during which Darwin Port advised that it had no comments on this EP or the DPD Offshore CEMP and supported the project. On 20 December 2023 Santos emailed Darwin Port confirming the discussion. [Con-3005].
- No further feedback or correspondence was received from Darwin Port.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Port.	Nil	Nil	Nil

NT Ports and Marine

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT Ports and Marine to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT Ports and Marine further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from NT Ports and Marine.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by NT Ports and Marine.	Nil	Nil	Nil

Sun Cable

Summary of consultation effort:

- On 9 November 2023 Santos emailed Sun Cable to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Sun Cable further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Sun Cable.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Sun Cable.	While no objections or claims were raised by Sun Cable, Santos notes that it is in regular communication with all current and future subsea cable owners/operators,	Nil	Nil

	including Sun Cable, on interaction required for DPD operational activities.		

Telstra

Summary of consultation effort:

- On 9 November 2023 Santos emailed Telstra to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Telstra further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 18 December 2023 Santos phoned Telstra to follow up on previous emails and seek any feedback on the proposal. [Con-3006]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Telstra.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Telstra.	While no objections or claims were raised by Telstra, Santos notes that it is in regular communication with all current and future subsea cable owners/operators, including Telstra, on interaction required for DPD operational activities.	Nil	Nil

Vocus

Summary of consultation effort:

- On 9 November 2023 Santos emailed Vocus to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Vocus further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call to Vocus and follow-up email on 20 December 2023. [Con-3007]
- On 21 December 2023 Vocus responded to Santos via email stating that it had already supplied a letter of no objections to the pipeline crossing the North-West Cable System (submarine fibre optic cable) owned and operated by Vocus and has been in contact with other parts of the Barossa team to ensure Vocus' assets are well protected while not impacting Santos' works schedule. [Con-3297]
- No further correspondence or feedback was received from Vocus.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Vocus.	While no objections or claims were raised by Vocus, Santos notes that it is in regular communication with all current and future subsea cable owners/operators, including Vocus, on interaction required for DPD operational activities.	Nil	Nil

Local Governments – Northern Territory

City of Darwin

Summary of consultation effort:

- On 9 November 2023 Santos emailed City of Darwin to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 City of Darwin emailed Santos to acknowledge receipt of the email. [Con-3246]
- On 22 November 2023 Santos emailed City of Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Santos followed-up the previous emails with a phone call to City of Darwin on 14 December 2023 and a follow-up email on 20 December 2023 [Con-2955]

- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from City of Darwin.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by City of Darwin.	Nil	Nil	Nil

Litchfield Council

Summary of consultation effort:

- On 9 November 2023 Santos emailed Litchfield Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Litchfield Council emailed Santos to acknowledge receipt of the email. [Con-3245]
- On 22 November 2023 Santos emailed Litchfield Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 November 2023 Litchfield Council emailed Santos to acknowledge receipt of the email. [Con-3252]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and email to Litchfield Council. [Con-2956]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Litchfield Council.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Litchfield Council.	Nil.	Nil.	Nil

Palmerston Council

Summary of consultation effort:

- On 9 November 2023 Santos emailed Palmerston Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 10 November 2023 Palmerston Council emailed Santos to acknowledge receipt of the email [Con-3249]
- On 22 November 2023 Santos emailed Palmerston Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 22 November 2023 Palmerston Council emailed Santos to acknowledge receipt of the email. [Con-3253]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and email to Palmerston Council. [Con-3018]
- On 18 December 2023 Palmerston Council responded via email to Santos stating it had no comments. [Con-3272]

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Palmerston Council.	Nil	Nil	Nil

Wagait Shire Council

Summary of consultation effort:

- On 9 November 2023 Santos emailed Wagait Shire Council to advise it of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Wagait Shire Council further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 15 December 2023 Santos followed-up the previous emails with a phone call to Wagait Shire Council and a follow-up email on the same day providing copies of the previous information sent on 9 November and 22 November. [Con-2957]
- On 20 December 2024 Santos sent a reminder email of the closing date for consultation. [Con-3235]
- On 21 December 2023 Wagait Shire Council responded via email to Santos stating the information had been forwarded to the CEO and councillors for any feedback. [Con-3301]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Wagait Shire Council.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Wagait Shire Council.	Nil	Nil	Nil

Tourism Operators

Alure Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Alure Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2997]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Alure Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Alure Fishing Charters.	Nil	Nil	Nil

Angler's Choice Fishing Safaris

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with phone calls on 14 and 20 December and a follow-up email on 22 December 2023 [Con-3019]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Angler's Choice Fishing Safaris.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Angler's Choice Fishing Safaris.	Nil	Nil	Nil

Arafura Bluewater Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Arafura Bluewater Charters responded via email to Santos stating that works on the pipeline duplication would affect its business as it runs charters in the area. [Con-3269]
- On 15 December 2023 Santos tried to contact Arafura Bluewater Charter via telephone. The call was not answered, and a message was left.
- On 21 December 2023 Santos followed-up the phone call with an email to Arafura Bluewater Charters asking if the company would like to meet with a Barossa Project representative in Darwin at a time and date suitable to Arafura Charters or the company could contact a mobile telephone number to speak directly with a representative. [Con-3327]
- On 8 January 2024 Santos tried to contact Arafura Bluewater Charter via telephone. The call was not answered, and a message was left.
- No further comments or input were received on this EP from Arafura Bluewater Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Arafura Bluewater Charters stated that works on the pipeline duplication would affect its business as it runs charters in the area.	Santos has attempted to contact the company to gather more information and/or have a meeting to discuss the claim. The company has not responded to Santos' approaches. The claim does not contain any detail about the alleged potential impacts of DPD Project activities on the operator to allow Santos to assess that claim.	Nil	Nil

Arnhem Land Safaris

Summary of consultation effort:

- On 31 May 2024 Santos emailed Arnhem Land Safaris regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4235]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that Arnhem Land Safaris contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Arnhem Land Safaris by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities, or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Arnhem Land Safaris advised that it did not consider that the activities were relevant to its operations, as it operated on land and inland waters 300km east of Darwin.
- No further feedback or correspondence has been received from Arnhem Land Safaris.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Arnhem Land Safaris.	Nil	Nil	Nil

Bayview Marina

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call during which Bayview Marina advised that it did not want to be consulted on this EP or the DPD Offshore CEMP. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-2959]
- No further feedback or correspondence has been received from Bayview Marina.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Bayview Marina.	Nil	Nil	Nil

Buffalo Boat Hire

Summary of consultation effort:

- On 31 May 2024 Santos emailed Buffalo Boat Hire regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4240]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that Buffalo Boat Hire contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Buffalo Boat Hire by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Buffalo Boat Hire advised their activities were restricted to certain areas and they did not conduct tours that far from Darwin.
- No further feedback or correspondence has been received from Buffalo Boat Hire.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Buffalo Boat Hire.	Nil	Nil	Nil

Clearwater Island Lodge

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2996]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Clearwater Island Lodge.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Clearwater Island Lodge.	Nil	Nil	Nil

Cobourg Fishing Charters/Venture North

Summary of consultation effort:

- On 31 May 2024 Santos emailed Cobourg Fishing Charters/Venture North regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4236]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that Cobourg Fishing Charters/Venture North contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Cobourg Fishing Charters/Venture North by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities, or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which a representative of Cobourg Fishing Charters/Venture North advised that they had forwarded Santos' email to other parties within their business and requested that Santos email be re-sent so it could be forwarded to the head skipper. Santos did so that same day, also providing a mobile telephone number if Cobourg Fishing Charters/Venture North wished to speak to a Santos representative about any queries it may have [Con-4242].
- Cobourg Fishing Charters/Venture North confirmed via email to Santos that it does not operate in the waters where DPD activities will be conducted [Con-4267].
- No further feedback or correspondence has been received from Cobourg Fishing Charters/Venture North.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Cobourg Fishing Charters/Venture North	Nil	Nil	Nil

Crab Claw Island Resort

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 15 December 2023 Santos followed-up the previous emails with a phone call during which Crab Claw Island Resort advised that it did not want to be consulted on this EP or DPD Offshore CEMP.
- A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-2961]
- No further feedback or correspondence has been received from Crab Claw Resort.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Crab Claw Island Resort.	Nil	Nil	Nil

Cullen Bay Fish Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2995]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Cullen Bay Fish Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Cullen Bay Fish Charters.	Nil	Nil	Nil

Cullen Bay Marina

Summary of consultation effort:

- On 9 November 2023 Santos emailed NT tourism operators to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2962]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Cullen Bay Marina.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Cullen Bay Marina.	Nil	Nil	Nil

Darwin Bara Fishing Tours

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Bara Fishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Bara Fishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2994]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Bara Fishing Tours.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Barra Fishing Tours.	Nil	Nil	Nil

Darwin Dive Academy

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Dive Academy to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Dive Academy further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 19 and 20 December 2023 Santos followed-up the previous emails with phone calls and a follow-up email on 22 December 2023 [Con-3020]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Dive Academy.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Dive Academy.	Nil	Nil	Nil

Darwin Fish Seeker Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Fish Seeker Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:

- if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Fish Seeker Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 14 December 2023 [Con-3021]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Fish Seeker Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Fish Seeker Charters.	Nil	Nil	Nil

Darwin Harbour Cruises

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Harbour Cruises to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 9 November 2023 Darwin Harbour Cruises emailed Santos to acknowledge receipt of the email. [Con-3248]
- On 22 November 2023 Santos emailed Darwin Harbour Cruises further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2975]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Harbour Cruises.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Harbour Cruises.	Nil	Nil	Nil

Darwin Harbour Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Harbour Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed NT tourism operators further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 27 November 2023 Darwin Harbour Fishing Charters emailed Santos stating it was open to participate in the consultation process but provided no further comments. [Con-3256]
- On 22 March 2024 Santos emailed Darwin Harbour Fishing Charters and provided further opportunity to provide input by 28 March 2024 to the development of this EP. [Con-3531]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Harbour Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Harbour Fishing Charters.	Nil	Nil	Nil

Darwin Red Devil Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Red Devil Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Red Devil Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]

- On 14 December 2023 Santos followed-up the previous emails with a phone call during which Darwin Red Devil Fishing Charters advised that it did not want to be consulted on this EP. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-2976].
- •No further correspondence or feedback was received from Darwin Red Devil Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Red Devil Fishing Charters.	Nil	Nil	Nil

Darwin Sailing Club

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Sailing Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Sailing Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2993]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Sailing Club.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Sailing Club.	Nil	Nil	Nil

Darwin Trailer Boat Club

Summary of consultation effort:

- On 9 November 2023 Santos emailed Darwin Trailer Boat Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Darwin Trailer Boat Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos had a telephone discussion with Darwin Trailer Boat Club which requested the previous email of 22 November 2023 be re-sent.
- On 14 December 2023 Santos followed-up the phone call with an email re-attaching the 22 November 2023 email. [Con-3205]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Darwin Trailer Boat Club.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Darwin Trailer Boat Club.	Nil	Nil	Nil

Dinah Beach Cruising Yacht Club

Summary of consultation effort:

- On 9 November 2023 Santos emailed Dinah Beach Cruising Yacht Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Dinah Beach Cruising Yacht Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2992]
- On 21 December 2023 Dinah Beach Cruising Yacht Club responded via email advising that the information had been forwarded to its committee which would respond by the due date if inclined. [Con-3298]
- Notwithstanding the information provided and the steps described above, no further correspondence or feedback was received from Dinah Beach Cruising Yacht Club.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Dinah Beach Cruising Yacht Club.	Nil	Nil	Nil

Dundee Beach Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Dundee Beach Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Dundee Beach Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2991]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Dundee Beach Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Dundee Beach Fishing Charters.	Nil	Nil	Nil

Equinox Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Equinox Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Equinox Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call during which Equinox Fishing Charters advised that it did not want to be consulted on this EP or DPD Offshore CEMP.
- A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-2977].
- No further correspondence or feedback was received from Equinox Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Equinox Fishing Charters.	Nil	Nil	Nil

Estuary Escapes Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Estuary Escapes Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Estuary Escapes Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-3023]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Estuary Escapes Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Estuary Escapes Fishing Charters.	Nil	Nil	Nil

Fish the Top End Fishing Charters (incorporating Obsession Fishing Safaris and Vision Sport Fishing Adventures)

Summary of consultation effort:

- On 9 November 2023 Santos emailed Fish the Top End Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Fish the Top End Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos had a telephone discussion with Fish the Top End Fishing Charters which advised it also represented 2 other operators (as listed) and requested the previous email of 22 November 2023 be re-sent. [Con-2998]
- On 14 December 2023 Santos followed-up the phone call with an email re-attaching the 22 November 2023 email. [Con-3025]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Fish the Top End Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Fish the Top End Fishing Charters.	Nil	Nil	Nil

FNA Sports Fishing

Summary of consultation effort:

- On 9 November 2023 Santos emailed FNA Sports Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed FNA Sports Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2990]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from FNA Sports Fishing.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by FNA Sports Fishing.	Nil	Nil	Nil

Mousies Barra Fishing Charters

Summary of consultation effort:

- On 31 May 2024 Santos emailed Mousies Barra Fishing Charters regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4241]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that Mousies Barra Fishing Charters contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Mousies Barra Fishing Charters by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities, or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Santos provided further information to Mousies Barra Fishing Charters on the proposed activities detailed in the information booklet.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Mousies Barra Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Mousies Barra Fishing Charters	Nil	Nil	Nil

Humbug Fishing

Summary of consultation effort:

- On 9 November 2023 Santos emailed Humbug Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Humbug Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2989]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Humbug Fishing.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Humbug Fishing.	Nil	Nil	Nil

Offshore Boats Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Offshore Boats Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Offshore Boats Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos had a telephone discussion with Offshore Boats Fishing Charters which requested the previous email of 22 November 2023 be re-sent.
- On 14 December 2023 Santos followed-up the phone call with an email re-attaching the 22 November 2023 email. [Con-3026]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Offshore Boats Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Offshore Boats Fishing Charters.	Nil	Nil	Nil

Outback Fishing Charters

Summary of consultation effort:

- On 31 May 2024 Santos emailed Outback Fishing Charters regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.[Con-4237]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process
- The email requested that Outback Fishing Charters contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Outback Fishing Charters by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Santos left a detailed message reminding Outback Fishing Charters of the deadline to advise whether it considered itself to be relevant for the DPD EP or DPD CEMP.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Outback Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Outback Fishing Charters.	Nil	Nil	Nil

Palmerston Game Fishing Club

Summary of consultation effort:

- On 9 November 2023 Santos emailed Palmerston Game Fishing Club to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Palmerston Game Fishing Club further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call during which Palmerston Game Fishing Club advised that the information sent by Santos was included in a newsletter to members on 10 December. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-2978]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Palmerston Game Fishing Club.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Palmerston Game Fishing Club.	Nil	Nil	Nil

Reel Screamin Barra Fishing

Summary of consultation effort:

- On 9 November 2023 Santos emailed Reel Screamin Barra Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.

- On 22 November 2023 Santos emailed Reel Screamin Barra Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call during which Reel Screamin Barra Fishing advised that it was not affected by this EP or DPD Offshore CEMP activities. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion [Con-2979]
- Notwithstanding the information provided and the steps described above, no further comments or input were received on this EP from Reel Screamin Barra Fishing.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Reel Screamin Barra Fishing.	Nil	Nil	Nil

River and Reef

Summary of consultation effort:

- On 31 May 2024 Santos emailed River and Reef regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4239]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that River and Reef contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from River and Reef by 7 June 2024, it would assume that it did not have functions, interests or activities that may be affected by the DPD activities or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Santos left a detailed message reminding River and Reef of the deadline to advise whether it considered itself to be relevant for the DPD EP or DPD CEMP.
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from River and Reef.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by River and Reef.	Nil	Nil	Nil

Sail Darwin

Summary of consultation effort:

- On 9 November 2023 Santos emailed Sail Darwin to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Sail Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2987]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Sail Darwin.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Sail Darwin.	Nil	Nil	Nil

Saltwater Cultural Tours

Summary of consultation effort:

- On 9 November 2023 Santos emailed Saltwater Cultural Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Saltwater Cultural Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-3028]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Saltwater Cultural Tours.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Saltwater Cultural Tours.	Nil	Nil	Nil

Sea Darwin

Summary of consultation effort:

- On 9 November 2023 Santos emailed Sea Darwin to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Sea Darwin further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 14 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email the same day. [Con-3027]
- On 14 December 2023 Sea Darwin responded via email to Santos stating it had no comments on this EP or DPD Offshore CEMP activities. [Con-3268]
- No further correspondence or feedback was received from Sea Darwin.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Sea Darwin.	Nil	Nil	Nil

Shoal Bay Sportfishing Tours

Summary of consultation effort:

- On 9 November 2023 Santos emailed Shoal Bay Sportfishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Shoal Bay Sportfishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call during which Shoal Bay Sportsfishing Tours advised that it did not want to be consulted on this EP or the DPD Offshore CEMP. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion [Con-2980]
- No further correspondence or feedback was received from Shoal Bay Sportfishing Tours.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Shoal Bay Sportfishing Tours.	Nil	Nil	Nil

Skippers at Dundee

Summary of consultation effort:

- On 31 May 2024 Santos emailed Skippers at Dundee regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. The email advised that Santos was seeking information to better understand what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities. [Con-4238]
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process.
- The email requested that Skippers at Dundee contact Santos by 7 June 2024 to advise whether it considers that it may be a Relevant Person and what functions, interests or activities it has that may be affected by the DPD activities.
- In the email Santos advised if it did not hear from Skippers at Dundee by 7 June 2024 it would assume that it did not have functions, interests or activities that may be affected by the DPD activities or did not wish to be consulted for either the DPD EP or DPD CEMP.
- On 6 June 2024 Santos followed up the email of 31 May 2024 with a phone call during which Skippers at Dundee advised that the activities were not likely to affect their operations as their tours do not run that far from Darwin, but it would contact Santos if it had any further questions.
- No further correspondence or feedback was received from on this EP from Skippers at Dundee.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Shoal Bay Sportfishing Tours.	Nil	Nil	Nil

Spring Tide Safaris

Summary of consultation effort:

- On 9 November 2023 Santos emailed Spring Tide Safaris to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Spring Tide Safaris further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]

- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2986]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Spring Tide Safaris.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Spring Tide Safaris.	Nil	Nil	Nil

Streeter Cruises

Summary of consultation effort:

- On 9 November 2023 Santos emailed Streeter Cruises to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Streeter Cruises further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2985]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Streeter Cruises.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Streeter Cruises.	Nil	Nil	Nil

Territory Guided Fishing

Summary of consultation effort:

- On 9 November 2023 Santos emailed Territory Guided Fishing to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Territory Guided Fishing further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2984]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Territory Guided Fishing.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Territory Guided Fishing.	Nil	Nil	Nil

Tiwi Island Adventures

Summary of consultation effort:

- On 9 November 2023 Santos emailed Tiwi Island Adventures to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Tiwi Island Adventures further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023 [Con-2983]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Tiwi Island Adventures.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Tiwi Island Adventures.	Nil	Nil	Nil

Tiwi Island Retreat

Summary of consultation effort:

- On 9 November 2023 Santos emailed Tiwi Island Retreat to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Tiwi Island Retreat further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call during which Tiwi Island Retreat advised that it did not want to be consulted on this EP. A follow-up email was sent by Santos on 20 December 2023 confirming the phone discussion. [Con-3264]
- No further correspondence or feedback was received from Tiwi Island Retreat.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Tiwi Island Retreat.	Nil	Nil	Nil

Top End Barra Fishing Tours

Summary of consultation effort:

- On 9 November 2023 Santos emailed Top End Barra Fishing Tours to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Top End Barra Fishing Tours further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- On 13 December 2023 Santos followed-up the previous emails with a phone call and a follow-up email on 20 December 2023. [Con-2981]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Top End Barra Fishing Tours.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Top End Barra Fishing Tours.	Nil	Nil	Nil

Yknot Fishing Charters

Summary of consultation effort:

- On 9 November 2023 Santos emailed Yknot Fishing Charters to advise the start of preliminary consultation regarding proposed activities for consultation to be managed under this EP and the DPD Offshore CEMP. [Con-3236]
- The email advised that Santos was seeking information to better understand:
  - if you are from a government Department or agency, how the proposed DPD activities may be relevant to your department or agency; and
  - what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.
- The email included information on the regulatory process for the activities in Commonwealth and NT jurisdictions and links to a Santos information booklet on the proposed activities and a NOPSEMA brochure on the consultation process and details of how to contact Santos to register as a Relevant Person. The email stated that the consultation phase would commence on 22 November 2023 and close on 22 December 2023.
- On 22 November 2023 Santos emailed Yknot Fishing Charters further to the previous correspondence, to advise that it had commenced the consultation phase which would run until 22 December 2023. In addition to the previous information again being provided, Santos provided information on Relevant Persons' entitlements under the regulatory processes, details of how to provide feedback and a reminder of the closing date for consultation. [Con-3238]
- Notwithstanding the information provided and the steps described above, no comments or input were received on this EP from Yknot Fishing Charters.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
No objections or claims were raised by Yknot Fishing Charters.	Nil	Nil	Nil

5. Impact and risk assessment methodology

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Evaluation of environmental impacts and risks (5) The environment plan must include: a. details of the environmental impacts and risks for the activity; and b. an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk; and c. details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. (6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: a. all operations of the activity; and b. potential emergency conditions, whether resulting from accident or any other cause.

Environmental impact and risk assessment is the process by which planned and unplanned events that will or may occur during an activity are assessed for their impacts on the environment (as defined in section 5 of the OPGGS(E)R) at a defined location and specified time period. In addition, unplanned events are assessed on the basis of their likelihood of occurrence, which defines their risk level.

Santos has undertaken environmental impact and risk assessments for the planned events and unplanned events in accordance with the OPGGS(E)R.

This section of the EP provides information relating to the environmental impact and risk assessment approach, specifically:

- terminology used
- summary of the approach used.

The process used to identify, analyse and evaluate environmental impacts and risks is fully described in Santos' Offshore Division Offshore Division Environmental Hazard Identification and Assessment Guideline (EA 91 IG 00004).

5.1 Impact and risk assessment methodology

Common terms applied during the environmental impact and risk assessment process, and used in this EP, are defined in Table 5-1.

Table 5-1: Impact and risk assessment terms and definitions

Term	Definition
Acceptability	Determined for both impacts and risks. Acceptability of events is in part determined by the consequence of the impact following management controls. Acceptability of unplanned events is in part determined from its risk ranking following management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos policies, consistency with all applicable legislation, and consideration of information received through consultation when determining management controls.
Activity	Specific tasks and actions undertaken throughout the lifecycle of oil and gas exploration, development, production and decommissioning.
ALARP	As Low as Reasonably Practicable The term refers to reducing impact and risk to a level that is as low as reasonably practicable. In practice, this means showing (through reasoned and supported arguments) that there are no other practical measures that could reasonably be taken to reduce impacts or risks further (NOPSEMA Guidance Note: ALARP, dated 1/08/2022 (N-04300-GN01660166 A138249); NOPSEMA Guideline: Environment plan decision making guideline, dated 10/01/2024 (N-04750-GL1721 A524696).
Authorised person	Person with the authority to make a decision or take an action. Examples are vessel master, superintendent, supervisor, person-in-charge, company authorised representative, and project manager.
Control measure	Is defined by the OPGGS(E)R to mean a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental impacts and risks.

Term	Definition
ENVID workshop	Environmental hazard identification workshop.
Environment	Is under the OPGGS(E)R as: (a) ecosystems and their constituent parts, including people and communities (b) natural and physical resources (c) the qualities and characteristics of locations, places and areas (d) the heritage value of places; and includes (e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).
Environmental consequence	A consequence is the outcome of an event affecting objectives. Note 1 An event can be one or more occurrences and can have several cases. Note 2 An event can consist of something not happening. *(Reference ISO 73:2009 Risk Vocabulary)*
Environmental impact	Defined by the OPGGS(E)R as any change to the environment, whether adverse or beneficial, wholly or partly resulting from an activity.
Environmental risk	Applies to unplanned events. Risk is a function of the likelihood of the unplanned event occurring and the consequence of the environmental impact that arises from that event.
Grossly disproportionate	Where the sacrifice (cost and effort) of implementing a control measure to reduce impact or risk, grossly exceeds the environmental benefit to be gained.
Hazard	A situation with the potential to cause harm.
Impact assessment	The process of determining the consequence of an impact (in terms of the consequence to the environment) arising from a planned or unplanned event over a specified time period.
Likelihood	The chance of an unplanned event occurring.
Non-routine planned event	An attribute of the planned activity that may occur or will occur infrequently during the planned activity. A non-routine planned event is intended to occur at the time.
Planned activity	The activity to be undertaken under this EP, including the services, equipment, products, assets, personnel, timing, duration and location and aspect of the activity.
Planned event	An event arising from the activity that is done with intent (i.e. not an unplanned event) and has some level of environmental impact. A planned event could be routine (expected to occur consistently throughout the activity) or non-routine (may occur infrequently if at all). Air emissions and activity discharges are examples of planned events.
Receptor	A feature of the environment that may have values.
Risk	The effect of uncertainty on objectives.
Risk assessment	The process of determining the likelihood of an unplanned event and the consequence of the impact (in terms of economic, human safety and health, or ecological effects) arising from the event over a specified time period.
Routine planned event	An attribute of the planned activity that results in some level of environmental impact and will occur continuously or frequently through the duration of the planned activity.
Unplanned event	An event that results in some level of environmental impact and may occur despite preventive safeguards and control measures being in place. An unplanned event is not intended to occur during the activity.

5.2 Summary of the environmental impact and risk assessment approach

5.2.1 Overview

Santos operates under an overarching Risk Management Policy. The company Risk Procedure underpins the Risk Management Policy and is consistent with the requirements of AS/NZS ISO 31000:2018, Risk Management – Guidelines (ISO, 2018).

The key steps to risk management are illustrated in Figure 5-1, as defined in the Santos Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004)

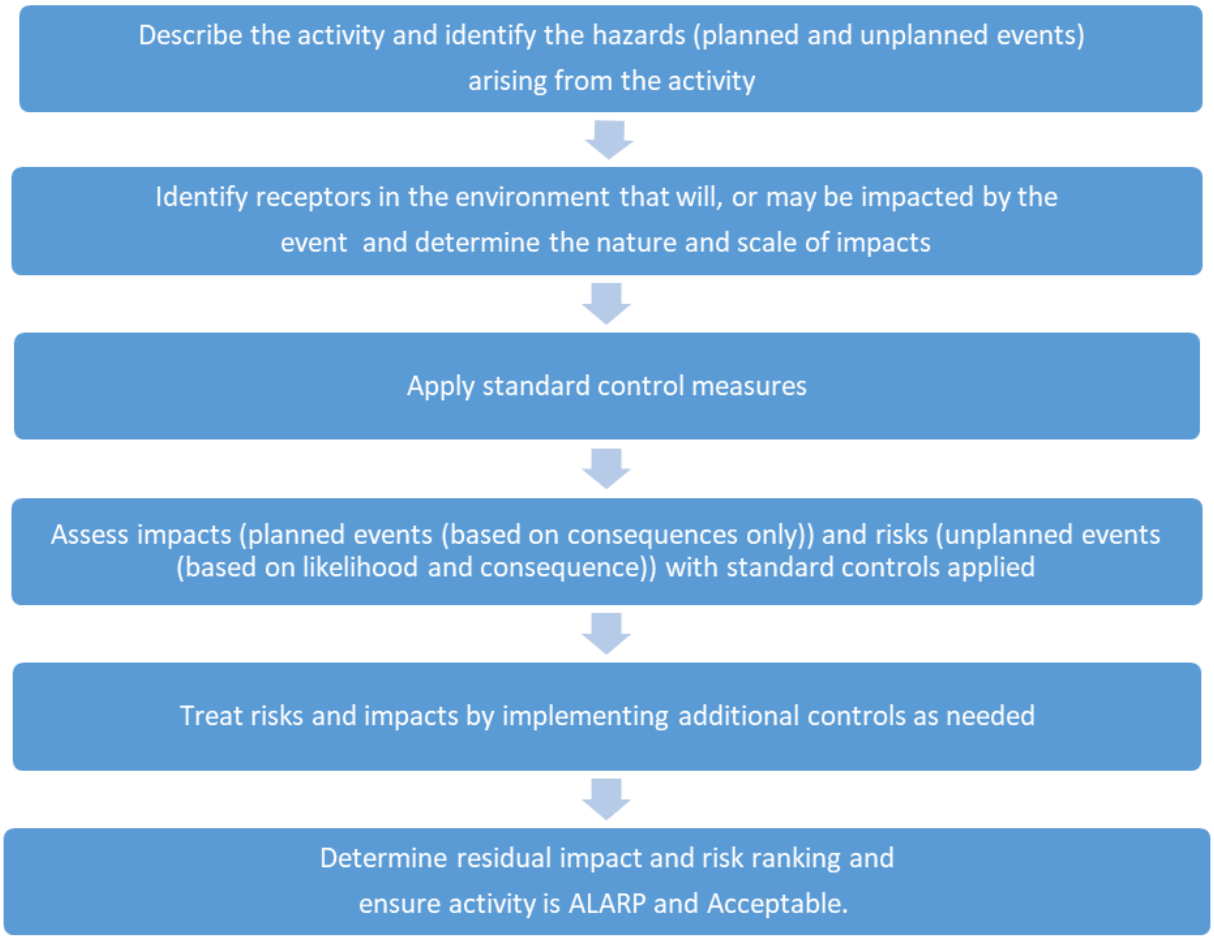

Figure 5-1: Hazard identification and assessment guideline

These steps are considered in activity-specific environmental assessment workshop(s) (ENVID workshop) and in the development of this EP. The workshop involves participants from Santos' Health, Safety and Environment (HSE), Spill Response and relevant departments, and specialist environmental consultants.

5.2.2 Describe the activity and hazards (planned and unplanned events)

The location, timing and scope of the Activity must be understood to define the hazards and determine the impacts from planned events, and the impacts and risks from unplanned events since these have a bearing upon the EMBA.

The outcome of this assessment is detailed in the relevant subsections of Sections 6 and 7.

5.2.3 Identify receptors and determine nature and scale of impacts

A description of the environment within which hazards from the Activity will, or may occur, is required. This constitutes a crucial stage of the risk assessment, as an understanding of the environmental, socioeconomic and cultural features values and sensitivities that will or may be affected is required to determine the type and consequence of impacts from the Activity being assessed.

The environment must be understood with respect to the spatial and temporal limits of the Activity and key resources at risk that will or could be impacted by planned and unplanned events. Section 3 describes the existing environment that may be affected by the Activity and is informed through consultation (refer Section 4). A protected matters search was conducted over the Activity EMBA to identify occurring or potentially occurring receptors. These receptors are detailed in Section 3.

An ENVID workshop (as described in Section 5.1) was held in October 2021 to consider the GEP activities and this Activity. A second ENVID workshop was held in May 2023 to revalidate the impact assessment based on changes to the Activity description. A third ENVID workshop was held in February 2024 to revalidate the impact assessment and consider new information relating to receptors (including values and sensitivities obtained during consultation), changes to the Activity description and new requirements (such as changes to legislation, other requirements and guidelines).

The extent of impacts from planned Activities or risks and impacts from unplanned events were assessed using, where required, modelling (e.g. hydrocarbon release) and scientific reports. The expected duration of each event was also defined using subject matter expertise.

Santos assessed the cumulative impacts of the Activity with other marine users. However, due to the relatively remote offshore location of the OA and the very short duration of the Activity, it is unlikely that there will be a cumulative impact above impact thresholds with other marine users.

5.3 Describe the environmental performance outcomes and control measures

As required by the OPGGS(E)R, environmental performance outcomes(s) (EPOs), control measures, environmental performance standards (EPSs) and measurement criteria were identified for the identified environmental impacts and risks.

All reasonably practicable control measures were considered and either accepted for use or rejected based on whether impacts and risks had been reduced to levels considered acceptable and ALARP.

Accepted control measures were allocated in order of preference, as shown in Figure 5-2.

Control	Effectiveness	Example
Eliminate		*Removal of the risk.* Refueling of vessels at port eliminates the risks of an offshore refueling.
Substitute		*Change the risk for a lower one.* The use of low-toxicity chemicals that perform the same task as a more toxic additive.
Engineering		*Engineer out the risk.* The use of oil-in-water separator to minimise the volume of oil discharged.
Isolation		*Isolate people or the environment from the risk.* The use of bunding for containment of bulk liquid materials.
Administrative		*Provide instructions or training to people to lower the risk.* The use of Job Hazard Analysis to assess and minimise the environmental risks of an activity.
Protective		*Use of protective equipment.* Containment and recovery of spilt hydrocarbons.

Figure 5-2: Hierarchy of controls

5.4 Determine the impact consequence level and risk rankings

The consequence level of a potential impact was determined for each planned and unplanned event using Santos' environment consequence descriptors (Appendix H) and assuming that all control measures had been implemented.

These detailed environmental consequence descriptions are based on the consequence of the impact to relevant receptors within the categories of:

- threatened/migratory/local fauna
- physical environment/habitat
- threatened ecological communities
- protected areas

- socioeconomic receptors
- cultural features.

Consequence descriptors are based on set criteria for each receptor category and take 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.

When assessing impacts to cultural features that are part of the environment that may be affected by the Activity, Santos considered cultural features of the environment as defined under the OPGGS(E)R):

(a) ecosystems and their constituent parts, including people and communities

(b) natural and physical resources

(c) the qualities and characteristics of locations, places and areas

(d) the heritage value of places

When assessing the consequence level of impact to cultural features, Santos considers the different types of cultural features and types of impacts. For impacts to cultural features, in the form of impacts to marine species that are either a cultural food source or are considered culturally significant to First Nations people, Santos assesses impacts with reference to the consequence assessment for threatened/migratory/local fauna. Similarly, where cultural features are linked to a specific place, impacts to cultural features are assessed with reference to the consequence assessment for physical environment/threatened ecological communities/protected areas as applicable. Where there are concerns raised by individuals about cultural and spiritual beliefs that do not link to a specific location or place, Santos will evaluate impact and risk acceptability with consideration for assessment of impacts from analogous activities (e.g. historical drilling, trawl fishing activity, industrial shipping) and consider culturally appropriate measures in response to concerns raised by individuals.

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

Table 5-2: Summary environmental consequence descriptors

Consequence level	Consequence level description
I	Negligible – No impact or negligible impact
II	Minor – Detectable but insignificant change to local population, industry or ecosystem factors
III	Moderate – Significant impact to local population, industry or ecosystem factors
IV	Major – Major long-term effect on local population, industry or ecosystem factors
V	Severe – Complete loss of local population, industry or ecosystem factors and/or extensive regional impacts with slow recovery
VI	Critical – Irreversible impact to regional population, industry or ecosystem factors

For unplanned events, the consequence level of the impact was combined with the likelihood of the impact occurring (Table 5-3) to determine a residual risk ranking using Santos' corporate risk matrix (Table 5-4).

Table 5-3: 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 to occur even in the long term

Table 5-4: Santos 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

5.5 Evaluate if impacts and risks are ALARP

For planned and unplanned events, an ALARP assessment was undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are adopted. The level of detail included within the ALARP assessment is based on the nature and scale of the potential impact or risk (e.g. more detail is required for a risk ranked as 'Medium' compared with a risk ranked as 'Low').

5.6 Evaluate impact and risk acceptability

Santos considers an impact or risk associated with the activities to be acceptable if each of the following criteria, where relevant, is satisfied:

- the consequence of a planned event is ranked as I or II; or a risk of impact from an unplanned event is ranked Very Low to Medium
- an assessment has been completed to determine that sufficient information or studies have been considered to validate the consequence assessment
- the principles of ecologically sustainable development (ESD) have been assessed
- the acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice
- performance outcomes, control measures and associated performance standards:
  - are consistent with legal and regulatory requirements
  - are consistent with Santos' Environment, Health and Safety Policy (Appendix A)
  - are consistent with industry standards
  - take into consideration Relevant Person feedback
  - have been demonstrated to reduce the impact or risk to ALARP.

6. Planned activities risk and impact assessment

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Evaluation of environmental impacts and risks (5) The environment plan must include: a. details of the environmental impacts and risks for the activity; and b. an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk; and c. details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. (6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: a. all operations of the activity; and b. potential emergency conditions, whether resulting from accident or any other reason. *Environmental performance outcomes and standards* (7) The environment plan must: a. set environmental performance standards for the control measures identified under paragraph (5)(c); and b. set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured; and c. include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

An ENVID workshop (as described in Section 5) for planned activities was held in October 2021 to consider the GEP activities and this Activity. Santos' environmental assessment identified 7 causes of environmental and socioeconomic impacts associated with the planned activities to be undertaken within the OA. A second ENVID workshop was held in May 2023 to revalidate the impact assessment based on changes to the Activity description. A third ENVID workshop was held in February 2024 to revalidate the impact assessment based on new information relating to receptors (including values and sensitivities obtained during consultation) (as described in Section 5.2.3) and changes to the Activity description and new requirements (such as changes to legislation, other requirements and guidelines) were also considered. The results of the impact assessments are summarised in Table 6-1 and described in the following subsections.

Table 6-1: Environmental impact assessment summary

EP section	Hazard	Residual consequence level
6.1	Interaction with other marine users	II – Minor
6.2	Seabed and benthic habitat disturbance	II – Minor
6.3	Noise emissions	II – Minor
6.4	Light emissions	II – Minor
6.5	Atmospheric emissions	I – Negligible
6.6	Vessel discharges	II – Minor
6.7	Activity discharges	II – Minor

6.1 Interactions with other marine users

6.1.1 Description of event

Event	The marine spread for the Activity includes: • the pipelay vessel, which will be operating along the DPD route 24/7 for a period during the pipelay activities • a construction vessel, which will be operating 24/7 during the Activity • support and supply vessels, which will transit to and from the pipelay and construction vessels daily • survey and other support will occur ad-hoc during the Activity. A 500 m exclusion zone will be established around the pipelay and construction vessels to safeguard them while they are unable to manoeuvre. All activity vessels will be limited to ≤8 knots within the OA. Sources of impact to other marine users may occur as a result of: • vessels frequently moving within and occasionally moving to and from the OA • helicopter operations to and from the OA • ROVs assisting vessel seabed installation within the OA • unplanned and non-routine IMR activities (e.g. post major cyclone) • physical ongoing presence post installation (e.g. potential snag hazard). Other marine users within the OA may include commercial shipping and fishing, tourism (including fishing charters), recreation, defence and traditional fishing.
Extent	Contained within the OA.
Duration	Total duration of the Activity (prior to the preservation period) is estimated to be 3 months. The pipelay activities are expected to be completed within approximately 2 weeks. The activities conducted near the PLET are likely to be completed within approximately 4 weeks, over a duration of approximately 2.5 months.

6.1.2 Nature and scale of environmental impacts

Potential receptors: socioeconomic (commercial fisheries, traditional fishing, tourism, recreation, shipping and defence).

Nine managed fisheries (4 Commonwealth, 5 NT) overlap the OA (Section 3.2.13.1). Table 3-16 provides a summary of the commercial fisheries and Santos' understanding of fishing effort based on publicly available information and consultation with Relevant Persons.

No active commercial fishing effort for 5 of the managed fisheries has occurred within the OA. There are 4 fisheries—Northern Prawn, Spanish Mackerel, Offshore Net and Line Fishery and Demersal Fishery—that may potentially occur within the OA. The Northern Prawn Fishery medium and high fishing effort is concentrated to the west and north of the Tiwi Islands and also to the south of the OA. The Spanish Mackerel Fishery fishing effort is concentrated at nearby shoals and banks as well as in the waters off Bathurst Island. The Offshore Net and Line Fishery fishing effort is concentrated near coastal areas and distribution of the targeted species; however, one licence holder may fish off the south-west coast of the Tiwi Islands for small pelagic fish. Demersal Fishery fishing effort is concentrated along the eastern boundary of the Timor Reef fishery in water depths of 80-100 m, to the north-east of the OA.

The OA is approximately 25 km south-west of the Tiwi Islands, NT. In 2014, the Blue Mud Bay Settlement Deed was signed by NT Government, Tiwi Land Trust and the Tiwi Land Council. Tiwi People are proposing to establish a Marine Indigenous Protected Area that extends to 3 Nm (approximately 5.6 km) around the Tiwi Islands (Tiwi Land Council, 2021). Traditional fishing effort is greatest near the larger communities of Wurrumiyanga on Bathurst Island, and Pirlangimpi and Milikapiti on Melville Island (DPIF 2014). Tiwi people continue to undertake the customary harvesting of sea turtles and dugongs. Green turtles are the main species harvested in the water while eggs of all turtle species are taken periodically. Dugongs are also taken occasionally (Tiwi Land Council, 2022).

The seabed within the OA is characterised as silty, shelly sand, with very sparse (<1%) epibiota with no known seabed features including fishing sites or locations of recreational interest (such as shipwrecks, coral reefs). The closest shoal is approximately 1.1 km from the DPD route. Tourism, recreation or traditional fishing are not expected in the OA, given the distance to Tiwi Islands (~25 km) and Darwin (~95 km), a lack of seabed features and water depth exceeding 50 m. However, there is the potential that tourism and recreational vessels may transit the area infrequently.

The OA intersects a designated defence practice area. The closest operational offshore production facilities and in-field subsea infrastructure are the Eni operated Blacktip Gas, approximately 254 km south-west from the OA and the Santos-operated Bayu–Undan platform, approximately 375 km north-west from the OA. There are 2 existing

pipelines within the vicinity—Bayu-Undan (greater than 0.1 km distant) and Ichthys (46.5 km distant). Darwin Port is a major shipping port in Australia located approximately 95 km south-east of the OA. In 2022–2023, there were 1,569 vessel calls to port (Landbridge Darwin Port, 2024). Although Darwin Port is the primary active port in the region, there is a port, Port Melville, located at the Tiwi Islands, which is approximately 83 km north-east of the OA and 125 km north of Darwin. Shipping and other incidental marine traffic are expected to be low based on AMSA's vessel traffic data (AMSA, 2022).

The temporary presence of activity vessels may inhibit other marine users. Helicopter operations within the OA will be short-term and limited to approximately 30 helicopter movements throughout the Activity, and are unlikely to interfere with other marine users as access around activity vessels will be restricted.

6.1.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No significant impacts to other marine users [EPO-01].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-2 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-2: Control measures evaluation for interaction with other marine users

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	Ensures vessel lighting, radios and equipment is inspected and maintained so that other marine users are aware of the vessel's physical presence, thus reducing the potential for interaction and collision. Demonstrates appropriately trained and competent personnel are used to navigate vessels to reduce interaction with other marine users.	Regulatory requirement and therefore the cost is not identified as an issue.	**Adopted**
C6.1.2	Undertake consultation with Relevant Persons (including applicable notifications) (administrative control)	Relevant Persons consultation ensures identified marine users are aware of the proposed activities, reducing the likelihood of unplanned interactions around activity vessels. Maritime notifications ensure marine users are informed of the proposed activities, reducing the likelihood of unplanned interactions. Subsea infrastructure will be clearly marked on Australian nautical charts published by the Australian Hydrographic Office (AHO) alerting other marine users to the presence of the installed infrastructure.	Cost to prepare and distribute information, and to address any feedback provided.	**Adopted**
C6.1.3	The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes (administrative control)	Santos marine vetting process ensures vessel lighting, radios and equipment are inspected and maintained so that other marine users are aware of the vessel's physical presence, thus reducing the potential for interaction and collision.	Standard maritime safety and navigational equipment; regulatory requirement and therefore the cost is not identified as an issue.	**Adopted**
Additional control measures				
C6.1.4	PLET protection structure designed to prevent snag and	Protection structure will provide additional anti-snag protection for fishers operating within proximity to the PLET.	Cost associated with the design, fabrication and installation of the structure.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	installed (engineering control)			
C6.1.5	Vessel speed restrictions (administrative control)	Restricting vessel speeds within the OA to ≤8 knots reduces the likelihood and consequence (causing harm) and likelihood of vessel-to-vessel collisions by providing vessels with more time to detect and manoeuvre to avoid each other.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.1.6	One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay (administrative control)	A vessel will be in the immediate vicinity of the pipelay vessel to act as a surveillance and intervention vessel. The vessel will mitigate potential interactions between the pipelay vessel and other marine users.	Cost associated with implementing procedures.	**Adopted**
C6.1.7	Communications plan will be implemented for engagement prior to and during the Activity (administrative control)	Communications plan will improve awareness of the Activity, encourage engagement with stakeholders, and provide up-to-date information regarding key activities.	Cost associated with implementing procedures.	**Adopted**
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Manage the timing of the Activity to avoid peak marine user periods (e.g. fishing) (elimination control)	Would reduce potential impacts to fisheries and other marine users.	Significant costs and increase in Activity duration to demobilise/remobilise the vessels. It also increases the risk profile of the operation.	**Rejected** – marine users may be present within the OA at any time of the year infrequently. Avoiding the fishing period is not considered justified given this and the disproportionate cost and delay it would cause.

6.1.4 Environmental impact assessment

Receptor	Consequence level
Interaction with other marine users	
Threatened, migratory or local fauna	Not applicable – related to socioeconomic receptors only.
Physical environment or habitat	
Threatened ecological communities	
Protected areas	

Receptor	Consequence level
Socioeconomic receptors	The OA does not intersect any moderate to high fishing effort areas. This is largely due to the seabed being characterised as silty, shelly sand, with very sparse (<1%) epibiota and the lack of seabed features such as shoals, reefs and banks. The control measures detailed in Table 6-2 (including a PLET protection structure) have been adopted to prevent snagging of trawling equipment. On an ongoing basis, it is not credible for any snagging of trawling equipment to result in a loss of containment of the DPD infrastructure (Intecsea, 2018 and 2022). The pipelay vessel will move slowly along the DPD route (nominally 2–3 km per day) with the pipelay activities expected to be completed within approximately 2 weeks. Activities proximal to PLET are likely to occur for a total of approximately 4 weeks, spanning over approximately 2.5 months (Section 2.6). Restricted areas within the OA are limited to the 500 m exclusion zone imposed around the pipelay and construction vessels. Helicopter operations will be infrequent (e.g. maximum helicopter movements will be approximately 10 times a week during the peak utilisation period) and at high altitude, they are therefore, unlikely to interfere with other marine users. Given the short duration of the Activity (approximately 3 months), the pipelay vessel moving slowly (1 knot in nominal 12 m steps) along the length of the DPD route, exclusion areas limited to 500 m around the pipeline and construction vessels, low fishing effort within the OA and distance from the coastline, interaction with commercial fisheries is possible but likely to be limited to fishers transiting within the region. On an ongoing basis, the subsea infrastructure may present a hazard to marine users due to the potential for snagging on subsea infrastructure. The risk of snagging was assessed during a fishing interactions survey undertaken for the DPD (Intecsea, 2018). Based on the frequency of trawling vessels crossing the pipeline and location of snagging hazards (e.g. pipeline spanning structures and downstream PLET) it was concluded that there is very low likelihood of trawling equipment becoming snagged on installed pipeline. To further reduce the risk, the PLET will be installed with anti-snag protection. While there may be some minor restrictions to where fishing activity can occur, no substantial adverse effects are considered likely given the very small area and temporary nature of exclusion (~3 months). The impact and risks are therefore deemed acceptable. Shipping and other incidental marine traffic in the area is expected to be low based on AMSA's vessel traffic data and that the OA is not in a shipping fairway (AMSA, 2022). Given all shipping vessels and activity vessels are required to comply with the COLREGS and associated Marine Orders, it is expected navigational and communicative aids are sufficient to prevent any negative interactions beyond basic avoidance of activity vessels. Therefore, impacts to shipping activity or commercial fishing vessels are not expected. At worst, a vessel may have to alter course to avoid a 500 m vessel exclusion zone. The OA is also distant from the coastlines, approximately 25 km south-west of the Tiwi Islands and 125 km north of Darwin, NT. Any interactions with recreational or traditional fishing, scuba diving operators or tourism vessels are expected to be restricted to temporary avoidance of activity vessels while transiting through the OA. The area from which marine users will be excluded is small when compared to the area available for their use and over a very short duration (~3 months). Marine users within the OA have coexisted with shipping activities and other nearby restricted areas (e.g. military exercises). Communication before and during the Activity will reduce the likelihood of unplanned interaction with other commercial marine users. Therefore, the consequence level for potential interaction with other marine users is considered to be I – Minor.
Cumulative impacts	
It is considered that negligible additive and cumulative effects associated with the Activity (e.g. physical presence) to other marine users may result, given the limited interaction with other marine users (including fishers, recreation and tourism operators) expected within the OA, an insignificant increase in regional vessel movements based on the annual Darwin Harbour statistics and historical year to year variation (refer to Section 3.2.13.5) and the very short Activity duration (~3 months). Therefore, no change to the overall consequence level is expected.	
Overall worst-case consequence	II – Minor

6.1.5 Demonstration of as low as reasonably practicable

There are no alternatives to using vessels to undertake the Activity. Activity vessels must have a 500 m exclusion zone, in accordance with the OPGGS Act. Santos' consultation process is described in Section 4. Throughout the consultation period, Relevant Persons were made aware of the proposed exclusion zone around the pipeline and construction vessels in accordance with the OPGGS Act and the implications to other marine users including the indicative schedule. No concerns have been raised by Relevant Persons regarding the potential exclusion zone. Notice to Mariners will be issued that detail the location and nature of activities and that the activity vessels will maintain navigation aids.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.1.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from interaction with other marine users is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available and Relevant Person consultation.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Not applicable. The OA does not intersect any AMP or protected area.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with the SOLAS and various Commonwealth Acts (*Marine Safety (Domestic Commercial Vessel) National Law Act 2012, Navigation Act 2012* and *OPGGS Act*). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback indicated no recommendations for revising the EPO, CMs or EPSs.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The consequence of interaction with other marine users is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.2 Seabed and benthic habitat disturbance

6.2.1 Description of event

Event	As described in Section 2.5, the installation activities will physically disturb the seabed. Disturbance to the seabed may result from: • long-term placement of subsea infrastructure on the seabed (e.g. Barossa DPD and supporting structures) • temporary placement and set down of equipment and subsea infrastructure on the seabed (e.g. ROV, acoustic positioning transponders, wet parking) • temporary seabed and sediment disturbance during installation (e.g. seabed rectification, if required). The seabed footprint is detailed in Table 2-7. Seabed disturbance may also cause a localised temporary increase in water turbidity.
Extent	Localised: within the OA.
Duration	Temporary disturbances and placements for the duration of the Activity (prior to the preservation period) being approximately 3 months and long–term subsea infrastructure placement for the operational life (approximately 25 years).

6.2.2 Nature and scale of environmental impacts

Potential receptors: physical environment (benthic habitat); threatened, migratory or local fauna (benthic fauna); socioeconomic (commercial fisheries and UCH); and cultural features.

The total seabed footprint from the Activity is provided in Table 2-7, which includes a 20% contingency. Section 2.5 describes the installation activities in detail.

The DPD and associated structures (including mattresses and grout bags for span rectification) are lowered onto the seabed in a controlled manner with minimal disturbance to sediment. Habitat directly below structures will most likely be replaced by the hard substrate of the structures, however, over time the structures will inevitably become colonised by epibenthic fauna that will most likely be similar in nature to those that are present on hard substrates at equivalent depths within the broader region.

6.2.2.1 Physical environment

The Activity will involve direct and indirect impact to the sea floor and will inevitably result in localised impact to benthic habitat (and associated fauna) within the OA.

The seabed within the OA is characterised as featureless silty, shelly sand (Figure 3-6), with very sparse (<1%) epibiota (mainly soft corals and crinoids) (RPS, 2023). Shepparton Shoal is the closest shoal or bank to the OA (Figure 3-5). The Barossa DPD route and OA was re-aligned during the preliminary engineering design to avoid Shepparton Shoal. Coarse sediment from span rectification (if required) is predicted to travel up to 400 m from the disturbance location and hence it is considered unlikely to impact Shepparton Shoal. Given the mobile nature of sediments and high current speeds, the seabed is expected to return to near its original state over time – no substantial changes to seabed features are predicted. The potential consequence on benthic communities is localised and limited given the very sparse cover of benthic communities and expected recovery through recolonisation. Benthic habitats and fauna assemblages that are expected to be impacted are considered widespread throughout the region. The Barossa DPD and supporting structures are expected to sink or become partially buried, with localised and low in relief sediment accumulation around the DPD due to the soft sediment. Although local scouring may occur, this is minimised through the structural integrity design. Depressions on the seabed caused by the activity are predicted to infill naturally with sediments and detrital matter over time and recovery and recolonisation of soft sediment habitats is expected to happen within a short time (weeks to months). Furthermore, the installed infrastructure will create a hard substrate in an otherwise featureless and soft seabed. It can be reasonably expected that the substrate could serve as an anchor for benthic organisms providing a localised increase in biodiversity after the Activity.

6.2.2.2 Water quality

Water quality impacts resulting from the Activity are anticipated to be limited to elevated suspended sediment and subsequent sediment deposition due to span rectification (if required). These effects are expected to be localised and short-term, with the water column returning to its original state within days. The impact on water quality is projected to be negligible, with no substantial changes that could adversely affect biodiversity, ecological integrity, social amenity, or human health. As such, the impact is considered acceptable.

6.2.2.3 Threatened, migratory or local fauna

The DPD route in Commonwealth waters is located in water depths of approximately 50 m to 60 m and in an area of high turbidity, limiting photosynthetically active radiation and benthic primary producer habitats (refer to Section 6.2.2.1).

Seabed disturbance from span rectification may temporarily make prey for predatory demersal fish (e.g. infauna) more available. Increased prey availability could result in a short-term attraction of demersal fish to the area. The seabed within the OA is predominantly bare sediment, which supports relatively low diversity and low abundance fish assemblages compared to more complex habitats (e.g. reefs). The installed infrastructure may create a more rugose seabed and provide a substrate for the attachment of organisms such as sponges and gorgonians (see Section 6.2.2.1). The resulting habitat will be relatively complex compared to much of the pre-existing habitat and will serve as an artificial reef. Recent survey work on the North West Shelf has highlighted the increased fish species richness and abundance associated with subsea pipelines (Bond et al., 2018; McLean et al., 2017). These studies noted that the fish assemblages associated with pipelines tended to have a relatively high portion of large, commercially important fish species that preferred complex habitats (Bond et al., 2018; McLean et al., 2017). The predicted increase in the fish assemblage diversity and abundance is not expected to have any adverse environmental consequences.

The protected matters search tool (PMST) report for the OA (Appendix D, summarised in Table 3-12) lists the following shark species with their respective conservation status: speartooth (critically endangered), northern river (endangered), white (vulnerable) and scalloped hammerhead (conservation dependent); and the NT-listed threatened shark species with their respective conservation status: speartooth (vulnerable) and northern river (endangered) (refer to Table 3-12). Due to the highly mobile nature and wide representation of these sharks as well as the limited seabed disturbance associated with the Activity, it is unlikely that these species will be adversely impacted.

The southern coastline of the Tiwi Islands hosts nesting populations of flatback turtles and internesting habitat critical for the survival of flatback turtles (Figure 3-15). Other species of marine reptiles, such as sea snakes and saltwater crocodiles, are not expected to be present in notable numbers within the OA and are not considered further. Flatback turtles forage in soft-bottom sub-tidal environments. Flatback turtles are carnivorous and feed opportunistically on a range of benthic invertebrates such as molluscs, crustaceans, soft corals and holothurians; pelagic prey such as jellyfish may also be consumed (Limpus, 2007). The OA does not contain suitable turtle foraging habitat and is deeper than foraging turtles typically dive to, particularly internesting females. Suitable internesting habitat for flatback turtles is defined as water depths shallower than 16 m (Whittock et al., 2016 in Pendoley, 2019), which is shallower than the shallowest point (greater than 50 m) along the Barossa DPD route.

Cape Fourcroy—located on the south western coastline of Bathurst Island, Tiwi Islands—also is a known flatback, olive ridley and green turtle nesting beach and supports an olive ridley turtle internesting BIA and habitat critical for the survival of flatback and olive ridley turtles (outside the OA) (Figure 3-12, Figure 3-15) (Pendoley, 2022).

Internesting olive ridley turtles remain relatively close to nesting beaches during the nesting period (in comparison to post-nesting movements); tagged turtles remained within 48 km of the nesting beach in waters typically <30 m water depth, although the turtles moved considerable distances within this radius (up to 200 km) (Hamel et al., 2008). These behaviours are consistent with observations from other populations, which indicate that internesting olive ridley turtles typically remain in relatively shallow waters within 30 km of the nesting beach (Maxwell et al., 2011; Rees et al., 2012). Internesting olive ridley and flatback turtles are expected to be concentrated in relatively shallow coastal waters (<30 m) around nesting beaches. Benthic habitat within the 30 m isobath around the Tiwi Islands is broadly represented regionally, and the OA is deeper than 30 m, ranging from 50 to 60 m. Therefore, seabed disturbance within the OA is unlikely to affect the internesting turtle habitat.

Based on the habitat preferences (shallower coastal and estuarine waters) of sawfish and the water depth of the OA, it is unlikely that they will be present in large numbers. It is recognised that individuals may be encountered within the OA including 3 sawfish species (dwarf, freshwater and green) listed as vulnerable under the EPBC Act and TPWC Act (Appendix D, summarised in Table 3-12). The proposed installed infrastructure is unlikely to result in adverse impacts to sawfish based on the following:

- mobile nature of sawfish species and preference for shallow habitat
- wide representation of habitats within the region
- localised seabed disturbance
- low profile of the Barossa DPD, which is expected to become partially or fully buried over time and considered unlikely to prevent the movement of sawfish over the pipeline.

Habitat modification is identified as a potential threat to several marine fauna species in relevant recovery plans and conservation advice (Table 3-14), some of which have cultural significance as totems or cultural food sources. However, seabed disturbance at the proposed scale is not anticipated to significantly affect marine fauna that may

be present in the OA, such as marine mammals, marine reptiles, sawfish, sharks, rays and other fish. The seabed within the OA is predominantly bare sediment and contains low abundance and diversity of infauna.

The area of seabed to be disturbed within the OA also represents a negligible portion of the habitat available for threatened, migratory or local fauna. There is also no significant benthic habitat and communities that will result in a reduction in food sources. Therefore, no impacts to marine mammals, cartilaginous fish or marine reptiles from seabed disturbance are expected.

6.2.2.4 Socioeconomic

6.2.2.4.1 Commercial fisheries

Potential impacts to benthic habitats, and subsequently to associated 'fish' species of commercial importance, will be localised and the potential impact to, and displacement of, fish is expected to be insignificant at a stock level.

6.2.2.4.2 Underwater Cultural Heritage

There is no known UCH (including First Nations) within the OA (see Section 3.2.13.7). Under the UCH Act, Australia's UCH (such as shipwrecks, sunken aircraft and other types) is protected, whether or not its existence or location is known (DCCEEW, 2023).

Cosmos Archaeology analysed data collected during the geophysical survey conducted by Fugro in 2021 along the DPD corridor. Cosmos Archaeology confirmed no cultural or magnetic anomalies were detected within the OA (Cosmos Archaeology, 2022; Appendix G). Therefore, no impacts to UCH (including First Nation UCH) sites are expected.

6.2.2.5 Cultural features

No First Nations people feedback was provided about potential seabed impacts to any geographically specific cultural features during consultation (refer to Table 4-10). The potential impacts to tangible cultural features from seabed disturbance are likely to be associated with any direct or indirect impacts to culturally significant marine fauna habitat and species (refer to Section 6.2.2.3). Notwithstanding the assessment findings, a PPUCH for underwater cultural heritage has been developed to manage any residual uncertainty and risk to tangible cultural features (in the highly unlikely event of a discovery) to ALARP (refer to Section 8.6.6). This protocol will be used to confirm the DPD route during pre-lay surveys and pipelay activities, which may require localised re-routing of the DPD in the highly unlikely scenario of a discovery.

Previous information potentially relevant to cultural features obtained during consultation for the D&C EP is included in this EP where relevant. Information provided during the UCH assessment for the GEP EP is also considered, having regard to the Court's findings and observations in *Munkara*. Feedback provided during the D&C EP consultation with Tiwi Clans identified concerns about the impact of drilling on their dreaming totems (including turtle totems), and about the impact of drilling on their spiritual dreaming which protects the Tiwi Islands and the potential for a disaster to strike the Tiwi Islands.

During consultation on the D&C EP, Tiwi clients of the EDO raised concerns about:

- disturbance to important ancestral spirits and beings, including Ampitji, that could result in loss of protection of the Tiwi Islands and result in exposure to natural disasters, reduced access to marine food sources and that it will cause Tiwi people to become sick. For example, if Ampitji is disturbed, there are concerns that there could be tidal waves or king tide, and that it may also disturb the 3 serpents who will shoot up out of the water like a cyclone, making a big wave causing a lot of damage.
- damage to the seabed from drilling could also harm imunga: spiritual places that are often connected to other sites, marine species and to Tiwi people. A related concern of the Tiwi clients of the EDO is that harming imunga could also impact on the health of land and sea country and access to food through traditional hunting and fishing.
- the drilling activity defined by some as "drilling through us, through our very being" and; "that if drilling starts, then that is killing our body" and that "Disturbing the sea has a domino effect on other things, on the life of the sea animals and on our lives and our very existence, including the spirit world. Disturbing the sea is disturbing the spirit world."

As presented in Section 3.2.14, some First Nations people cultural beliefs place significance on culturally important spiritual beings and the protection they afford First Nations communities from natural disasters and sickness. Dr Corrigan concluded that both the Tiwi Islanders and Larrakia Peoples' cultural and spiritual values within the OA are geographically indeterminate (Corrigan, 2024), based on the materials able to be considered. As part of his study, Dr Corrigan spoke directly with, and obtained information from, many First Nations people, including Larrakia people, Tiwi Islanders and members of the Belyuen community. Engagement with Tiwi Islanders undertaken by Dr Corrigan also shows that spiritual beings (e.g. crocodile man and Ampitji) are not widely thought to travel to and within the OA due to the distance from the Tiwi Islands, as expressed by some relevant and senior Tiwi people. Of

direct relevance these sorts of Tiwi cultural and spiritual values were tested in the Federal Court and were found not to be consistently spread amongst relevant Tiwi Islanders and in any event do not represent a particular 'place' of cultural and spiritual significance[44].

As presented in Section 3.2.14, some First Nations people believe that damaging songlines may have the potential to interfere with ability for First Nations people to reproduce cultural knowledge and continue to provide cultural education of their children.

During consultation for this EP, the Croker Island people did not identify any sacred sites or songlines within the OA, and no objections or claims were raised.

Santos recognises that some First Nations people remain concerned about the potential for adverse consequences to First Nations people and natural environment, that may arise as a result of disturbance from the Barossa Development to spiritual dreaming and culturally important spiritual beings. Santos understands the spiritual protection believed to be afforded to the First Nations people is broadly maintained by protecting the features of the natural environment and through ceremonial practices alerting the spiritual beings to the presence of people travelling through country and the like (Corrigan, 2023).

Dr Corrigan (2024) documented input from Larrakia people and relevant First Nations persons from Belyuen and Wagait, who advised the presence of a range of ancestral beings and dreaming stories of relevance to the Darwin Harbour, surrounding seas and the DPD Project footprint. None of these cultural features are known to be associated with any specific or particular places in the DPD Project footprint, but rather have a more general association with the wider area, as well as having associations with particular and specific places outside of the DPD Project footprint. In this regard, Dr Corrigan identified the following recommendation, as put to him by First Nations people:

"*that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities throughout the DPD construction process...*" (Corrigan, 2024)

While Dr Corrigan's assessment concluded that there are no particular places of specific cultural heritage vales[45] as opposed to a general heritage values in existence in the general area along the DPD route, Santos recognises the broad and cultural and spiritual beliefs and connections to First Nations people.

Santos has determined that the laying of the pipeline will have low impact and risk to cultural and/or spiritual beliefs because:

- no specific UCH places have been identified by Dr Corrigan, which is consistent with the conclusions arrived at through consultation with First Nations people and through the examination of relevant records in the course of preparing this EP
- these intangible cultural and spiritual heritage interests and connections have co-existed with other seabed disturbance activities in the region (including the area surrounding the Tiwi Islands) with no evidence to support actual adverse effects from the actions of spiritual beings in response to impacts on the environment. Regional seabed disturbing activities include fish trawling activities, drilling of nearly 900 offshore wells and subsea infrastructure placement, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016 and the North West Cable System since approximately 2016 and the GEP since 2023.
- on the views of some Tiwi Islanders who provided information to Dr Corrigan, there are no cultural impediments to the laying of the DPD
- even taking the highest views of Tiwi Islanders as to significance, being those expressed by the EDO's clients, the impact and risk will be low, and not significant, having regard to the existing state of the environment because the DPD will not meaningfully add to the level of disturbance currently experienced in the area
- the additional control measures proposed in this EP to further ensure impacts are reduced to ALARP and an acceptable level (being the implementation of the PPUCH for underwater cultural heritage (C6.2.11) if required and the cultural heritage control measure to implement the suggestions of First Nations people reported by Dr Corrigan).

Santos considers that control measure based on Dr Corrigan's recommendations will allow intangible impacts and risks to be reduced to ALARP and an acceptable level and has adopted these recommendations as C6.2.10.

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[44] *The concepts of places, sites and similar are used in various pieces of legislation that contain mechanisms to protect First Nations cultural heritage (including the ATSIHP Act, ALR Act and NTASS Act), to describe specific items or places that should be protected.*

[45] *See above*

6.2.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- Seabed disturbance limited to planned activities and defined locations within the OA [EPO-02]
- No significant impacts to cultural features from the Activity [EPO-14]
- No significant impacts to underwater cultural heritage from the Activity [EPO-15].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-3 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2.

Table 6-3: Control measures evaluation for seabed and benthic habitat disturbance

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.2.1	Confirmation of DPD route prior to and during installation (administrative control)	Ensures that the DPD is laid along the planned route, which was determined taking into account (amongst other factors) environmental and cultural sensitivities identified during the design and consultation phase. This control is very effective in avoiding sensitive receptors and span rectification by design.	Cost of surveys and maintaining records.	**Adopted**
C6.2.2	DP pipelay vessel will be used for installation of the DPD (substitution control)l)	Effective in eliminating seabed disturbance from an anchor.	The use of DP will generate broadband underwater noise; refer to Section 6.3 for the assessment of underwater noise impacts. The DP thrusters will increase fuel usage and atmospheric emissions.	**Adopted**
C6.2.3	Differential global positioning system (DGPS) for pipelay vessel to maintain accurate vessel position during installation (engineering control)	The control is effective in ensuring vessels, in combination with DP systems, are positioned with high accuracy. This ensures the DPD is installed along the desired route. The proposed DPD route has been designed to avoid sensitive benthic features and minimise the requirement for span rectification.	Costs are expected as part of standard procedure.	**Adopted**
C6.2.4	Underwater acoustic positioning systems used to ensure that designated infrastructure and supporting structures are installed within designed tolerances (engineering control)	Ensures that the PLET is installed as designed at the intended location, minimising seabed disturbance.	Cost of surveys and maintaining records.	**Adopted**
C6.2.5	Vessel planned maintenance system (administrative control)	Ensures DP equipment is operating within its parameters, eliminating the requirement for a vessel to anchor.	Costs are expected as part of standard procedure.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Provides crew awareness of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.2.6	Span correction procedures to be developed, if required (administrative control)	Provides clear direction on how spans shall be rectified and surveyed to minimise seabed disturbance.	Costs are expected as part of standard procedure.	**Adopted**
C6.2.7	No planned vessel anchoring within the OA, within the Habitat Protection Zones (IUCN IV) – Zone 2 of Oceanic Shoals Marine Park or in named banks or shoals (administrative control)	Effective in preventing anchoring on sensitive benthic habitats associated with the named banks and shoals in the region. The OA has been designed to avoid these features.	The use of DP will generate broadband underwater noise; refer to Section 6.3 for the assessment of underwater noise impacts. The DP thrusters will increase fuel usage and atmospheric emissions.	**Adopted**
C6.2.8	Establish a subsea infrastructure inventory (administrative control)	Enables Santos to fulfil future decommissioning and removal responsibilities.	Cost of surveys, maintaining equipment and records.	**Adopted**
C6.2.9	PPUCH for maritime underwater cultural heritage (administrative control)	Provides guidance in the event that an unexpected maritime archaeology find is encountered. By implementing the protocol, potential impacts to maritime UCH objects and values will be minimised.	Administrative costs to update existing Santos procedures and induction materials and train personnel.	**Adopted**
C6.2.10	Cultural heritage training and cultural ceremony (administrative control)	Santos has been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the GEP EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns.	Time and cost to work with First Nations communities.	**Adopted**
C6.2.11	PPUCH for First Nations underwater cultural heritage (administrative control)	Provides guidance in the event that an unexpected First Nations find is encountered. By implementing the protocol, potential impacts to First Nations UCH objects and values will be minimised.	Administrative costs to update existing Santos procedures and induction materials and train personnel.	**Adopted**

6.2.4 Environmental impact assessment

Receptor	Consequence level
Seabed and benthic habitat disturbance	
Physical environment or habitat	Localised sediment (silty, shelly sand) disturbance and turbidity caused by seabed disturbance is expected to be minor in nature and limited to within the OA.

Receptor	Consequence level
	Therefore, the consequence level is considered to be II – Minor.
Threatened, migratory or local fauna	Given the limited scale of seabed disturbance and knowledge of the existing environment, potential impact to threatened, migratory or local fauna species is unlikely. Habitat modification is identified as a potential threat to several marine fauna species in relevant recovery plans and conservation advice (Table 3-14). However, the benthic habitat within the OA is well represented in the wider surrounds and there are no known significant marine fauna feeding or aggregation areas within the OA. Marine invertebrates that may inhabit disturbed soft sediment benthic habitats are expected to occur elsewhere within the OA and surrounds. Therefore the disturbance is not expected to negatively affect prey availability for protected fauna species. Seabed disturbance is not expected to cause a significant decrease in local population size, area of occupancy of species, loss or disruption of critical habitat, and disruption to the breeding cycle of any threatened or migratory marine fauna. Therefore, the consequence level is considered to be II – Minor.
Threatened ecological communities	Not applicable – no threatened ecological communities were identified in the area where seabed disturbance could occur.
Protected areas	Not applicable – no protected areas over which seabed disturbance could occur.
Socioeconomic receptors	Seabed disturbance is not expected to impact commercial fisheries based on the small size of disturbance compared with the total available fishing area. There are no known heritage sites or clear evidence of shipwrecks or aircraft wrecks within the OA. If an unexpected find of underwater cultural heritage is identified during the pre-lay survey, the unexpected find will be assessed following the maritime UCH UFP (Attachment 1 of the PPUCH) to minimise potential impacts to maritime archaeology UCH objects and values (see Section 8.6.6). If required, Relevant Persons will be notified and the object managed in accordance with the UCH Act, as applicable (refer to C6.2.9 and Table 8-5). For assessment of impacts to First Nations UCH objects and values, refer to the assessment for cultural features. Santos considers the adoption of EPO-15 and C6.2.9, practicable and appropriate. The consequence of seabed disturbance on receptors is assessed as I – Negligible.
Cultural features	There are no sacred sites registered or recorded under the NTASS Act or protected under the ATSIHP Act, UCH Act, ALR Act or EPBC Act that overlap the OA. Of the culturally important sites (including underwater sites) identified by First Nations people, all of the identified sites are outside the OA. If a First Nations underwater cultural heritage unexpected find is identified during the survey or installation activities, the unexpected find will be assessed following the First Nations UFP (Attachment 2 of the PPUCH) to minimise potential impacts to First Nations UCH objects and values (see Section 8.6.6). If required, Relevant Persons will be notified and the object managed in accordance with the UCH Act, as applicable (refer to C6.2.11 and Table 8-5). For assessment of impacts to maritime archaeology UCH objects and values, refer to the assessment for socioeconomic receptors. For assessment of impacts to marine species of cultural significance, refer to the assessment for threatened, migratory or local fauna. In relation to seabed disturbance, Santos notes that existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016, and the North West Cable System since approximately 2016. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of almost 900 offshore wells. There is no evidence to support actual adverse effects from spiritual beings in response to impacts on people or the environment from these activities. Notwithstanding, a control measure (C6.2.10) relating to cultural heritage training and cultural ceremony was developed with input from Relevant Persons and acknowledges the recommendations by First Nations people as suggested to Dr Corrigan (Corrigan, 2024). Santos considers the adoption of EPO-14, EPO-15, C6.2.10, C6.2.11 and Table 8-5, practicable and appropriate.
Cumulative impacts	
The cumulative area of benthic disturbance, from relevant activities proposed within this EP, is an incidental proportion of similarly representative regional habitat, predominantly bare sediment with a low abundance and diversity of infauna. The additive effect of this Activity and existing infrastructure in the vicinity of the OA (e.g. Barossa GEP, Bayu-Undan pipeline, Ichthys pipeline and telecommunication cables) are expected to not substantially change or adversely impact on biodiversity or ecological integrity of benthic communities. Hence, additive and cumulative seabed and benthic habitat disturbance effects are considered negligible. Therefore, no change to the overall consequence level has resulted.	
Overall worst-case consequence	II – Minor

6.2.5 Demonstration of as low as reasonably practicable

There are no reasonably practicable better alternatives for installing subsea infrastructure. All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with Santos' risk management criteria and are considered appropriate to manage the impacts to ALARP.

In relation to spiritual and/or cultural heritage beliefs and connections to sea country and related concerns of some First Nations people, Dr Corrigan suggested that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities during the DPD construction process (Corrigan, 2024). For example, a common practice is the use of ceremonies to introduce activities or the presence of strangers to spiritual beings (refer to Section 3.2.14.11), this has been adopted in this EP where any First Nations Relevant Person has raised similar concerns, even if the concern was raised during consultation for the D&C EP and GEP EP and not expressly raised in relation to this EP. Santos has also been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the GEP EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns. Santos considers that the adopted control measures (C6.2.10) based on the Corrigan 2024 Report recommendations and the adoption of control measure (C6.2.11) will reduce environmental impacts and risks to ALARP, as relevant to First Nations individuals who hold these concerns in relation to their beliefs.

6.2.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence to seabed and benthic habitats is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available. Extensive marine studies have been completed within the OA to inform the assessment.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – while several plans identify habitat modification as a threat to marine fauna, significant impacts are not predicted for this Activity.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2. On 6 December 2023 and 10-11 January 2024, DCCEEW UCH Branch—responsible for administering the UCH Act—was consulted regarding the notification and management of potential UCH for the SURF EP. Feedback on C6.2.9 was affirmative and as a result also adopted for this EP.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – no objections or claims were specifically raised for this Activity. However, feedback received from the Corrigan 2024 Report, GEP EP and D&C EP has been considered and where applicable additional EPOs, CMs and EPSs (e.g. EPO-14, C6.2.6, C6.2.7, C6.2.9, C6.2.10 and C6.2.11) were adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The consequence of seabed and benthic habitat disturbance is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.3 Noise emissions

6.3.1 Description of event

Event	Potential impacts from noise emissions may occur in the OA from the following sources: • vessel activities (e.g. vessel engines, thrusters and other machinery and equipment) • acoustic positioning system on the pipelay and construction vessels • ROV activities • survey equipment • helicopter activities. The potential for cumulative noise effects from the Activity and other marine users (e.g. fishing, tourism and shipping) is acknowledged. Therefore, the cumulative impacts have been considered in this assessment.
Extent	• Localised: a representative pipelay vessel will have sound levels which do not exceed the marine mammal behavioural disturbance threshold beyond 9.8 km. • Localised: a conservative estimate for the use of survey equipment is within a few hundred metres radius. • Localised: a conservative estimate for the use of acoustic positioning system is within hundreds of metres of the source.
Duration	Continuous vessel noise emissions during the pipelay activities are expected to occur for a period of 2 weeks along the DPD route and approximately 4 weeks during a 2.5-month window proximal to the PLET, with intermittent emissions from discrete activities (e.g. helicopter movements, ROVs, acoustic positioning and survey equipment etc).

6.3.1.1 Introduction

Santos commissioned a technical study into underwater noise impacts on marine fauna (JASCO, 2020) using contemporary criteria and has used the findings to inform the underwater noise emissions impact assessment. Noise sources involved in the activities described in this EP include both non-impulsive and impulsive noise sources. Non-impulsive sounds have a longer duration than impulsive ones, and they usually do not have the high peak sound pressure and rapid rise and decay time that impulsive sounds have. However, especially in respect to their auditory effects on marine fauna, the term ‘non-impulsive’ does not imply long duration signals (JASCO, 2020). The relevant terminology for underwater acoustic levels relevant to non-impulsive sources are sound pressure levels (SPL), and accumulated sound exposure levels (SEL).

The assessment undertaken for the Barossa Development (ConocoPhillips, 2018) applied Southall et al. (2007) to assess potential hearing impairment in marine mammals. Southall et al. (2019) has improved the assessment approach for low-frequency (LF) cetaceans by determining the effect ranges and applying the unweighted SEL results and LF hearing group specific thresholds. Therefore, the modelling is considered conservative because it does not account for the weighting of frequencies for fauna that do not hear as well. Note also that Southall et al. (2021) reports further research recommendations that are aiming to improve the assessment of the severity of marine mammal behavioural responses to human noise.

6.3.1.2 Noise generated by vessels

Vessel operational noise includes machinery noise (e.g. engine noise), equipment noise (e.g. SBES) and hydrodynamic noise (e.g. water flowing past the hull, thruster use and propeller singing). The impacts associated with SBES (see Section 2.4) are considered negligible and hence not considered further. Machinery on a ship radiates sound through the hull into the water. During normal operations, the activity vessels will generate continuous noise from propeller cavitation, thrusters, hydrodynamic flow around the hull, and machinery and equipment operations. The activity vessels and their activities are listed in Table 2-3. Typically, 3 types of vessel operations will occur, 2 of which involve DP:

- vessel steaming at low speed during activity operation e.g. pipelay vessel
- manoeuvring during subsea infrastructure handling operations (vessels under DP)
- resupply activities to activity vessels (supply vessels under DP).

For activity vessels, the noisiest anticipated activity is when the vessel uses thrusters to maintain its position. McCauley et al. (1998) measured underwater SPLs equivalent to approximately 182 dB re 1 µPa @ 1 m with a frequency range of 20 Hz to 10 kHz from a support vessel holding station in the Timor Sea. The thruster noise dropped below 120 dB re 1 µPa within 3–4 km and was audible above ambient noise up to 20 km away (McCauley, 1998). This has been taken as the greatest noise-generating activity for assessment purposes, as other vessel

activities will require the vessel to be idle or moving. McCauley et al. (1998) measured underwater sound levels from the Pacific Ariki, a 64 m long support vessel with 6,000 kW main engines during calm conditions in the Timor Sea in 110 m of water while transiting at 11 knots, and found the distance to 120 dB re 1 µPa to be approximately 1 km.

6.3.1.3 Noise generated by a helicopter

Sound travelling from a source in the air (e.g. a helicopter) to a receiver underwater is affected by both in-air and underwater propagation processes, and processes occurring at the air/sea water surface interface (e.g. wind and waves). The level of noise received underwater depends on source altitude and lateral distance, receiver depth, water depth, and other variables.

Helicopter engine noise is emitted at various frequencies; however, the dominant tones are generally of a low frequency below 500 Hz (Richardson et al., 1995). Sound pressure in the water directly below a helicopter is greatest at the surface and diminishes with increasing receiver depth. Noise also reduces with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude, with sound penetrating water at angles less than 13° (Richardson et al., 1995). The noise from the flyover of a Bell 214ST helicopter has been recorded underwater (Richardson et al., 1995), with the maximum recorded sound level for the dominant 22 Hz tone was 109 dB re 1 µPa (SPL) when the helicopter was 152 m from the surface and the hydrophone 3 and 18 m under the surface.

For context, the Bell 214ST uses a single powerful Lycoming LTC4B-8 engine of 2,185 kW (Frawley, 2003), while the modern Bell 412, often used as a rescue helicopter in Australia (Air Services Australia, 2020) uses twin 1,250 hp (930 kW) turboshaft engines (Bell Helicopter, 2012). Typical offshore crew change and medivac helicopters in Australia are Leonardo AW139s (Milne, 2019), which have been measured to be 2 dB(A) quieter than the Bell 412 helicopters (Air Services Australia, 2020).

Helicopter activities produce strong underwater sounds for brief periods when the helicopter takes off/lands on the vessel. Sound from helicopter activities is very localised and infrequent. Further, helicopter operations are expected to result in received underwater noise levels lower than those associated with vessel operations.

6.3.1.4 Noise generated from survey equipment

Survey activities will be undertaken within the DPD OA to identify debris, seabed features, buried assets and obstructions. Survey activities may also be undertaken to confirm the location of the infrastructure and supporting structures with a duration of ~0.5 days per survey dependent on the area being surveyed. Survey methods will primarily involve:

- MBES, such as the Reson SeaBat 7125 transmitting at 400 kHz. At 400 kHz, it has a 1° beamwidth along the track, and a source level of 220 dB re 1 µPa (Coastal Frontiers, 2017)
- SBP with a chirp frequency range from 2 to 50 kHz, with 3 chirp transducers for 3 frequency ranges, 2 to 9 kHz, 10 to 20 kHz and 20 to 50 kHz. The in-beam estimated maximum source levels are about 200 to 205 dB re 1µPa @ 1 m (DOC, 2016). SBP with a boomer with a lower-frequency from 0.5 Hz to 5kHZ.
- SSS is generally considered a high acoustic density source and medium frequency generator. The frequency ranges from 75 to 900 kHz (Jiménez-Arranz et al., 2017). The sound pressure level ranges from 200–235 dB re 1µPa SPL.

6.3.1.5 Noise generated from acoustic positioning

An LBL or USBL acoustic positioning system will be used to accurately position seabed infrastructure. These systems provide accuracy up to one metre and are therefore critical for the safe and accurate installation of subsea infrastructure. Transponders will be active during calibration or positioning only. The operation duration is approximately 2 days for an array (expected to be one location). For USBL positioning, transponders are typically attached to subsea equipment and recovered once the equipment is correctly positioned on the seabed. For LBL, transponders are typically fixed to seabed frames and then fully recovered once subsea equipment is correctly positioned.

LBL and USBL systems work by emitting short pulses of medium– to high–frequency sound. Transmissions are not continuous but are short 'chirps' with a duration that ranges from 3–40 milliseconds.

The USBL system uses a vessel-mounted transceiver to detect the range and bearing to a target using acoustic signals. An acoustic pulse is transmitted by the transceiver and detected by the subsea transponder, which replies with its own acoustic pulse. This return pulse is detected by the shipboard transceiver. The time from the transmission of the initial acoustic pulse until the reply is detected is measured by the USBL system and is converted into a range. To calculate a subsea position, the USBL calculates both a range and an angle from the transceiver to the subsea beacon. Angles are measured by the transceiver, which contains an array of transducers. A method called ‘phase-differencing’ within this transducer array is used to calculate the angle to the subsea

transponder. The transducer will then send sound signals, typically at 19–33 kHz to a USBL transponder. Table 6-4 details the nominal specifications of likely acoustic positioning systems as detailed in McPherson (2020).

Table 6-4: Specifications of nominal acoustic positioning systems

Manufacturer	Model	Source frequency (kHz)	Source level (dB re 1 µPa @ 1 m)
Kongsberg	HiPAP 500	33	206
Sonardyne	Ranger USBL	18–36	204

6.3.1.6 Noise generated from ROV operations

ROVs and associated mounted equipment (e.g. cutting device) may be launched from activity vessels to undertake the activities described in Section 2.4.5.2 and Section 2.7.1. Typically, the noise generated from an ROV and associated mounted equipment will have a considerably lower intensity than vessel noise, survey equipment and acoustic positioning systems.

Underwater sound levels depend on the primary (noisiest) sound source rather than being strictly additive. ROV operations will be undertaken from a vessel, and thus will make little contribution to the overall noise emissions associated with vessel activities, survey equipment and acoustic positioning systems, as described in Sections 6.3.1.2, 6.3.1.4 and 6.3.1.5. ROVs and associated mounted equipment are not risk assessed further for noise impacts (see Section 6.3.1.7).

6.3.1.7 Summary of noise sources and rationale for assessment

Of the noise sources described in Sections 6.3.1.2 to 6.3.1.6, noise from helicopters and ROVs (and associated mounted equipment) is expected to be intermittent during the Activity and underwater received levels will not exceed that of activity vessels.

Therefore, the assessment focused on the operations of the activity vessels, survey equipment and acoustic positioning systems.

6.3.2 Nature and scale of environmental impacts

Potential receptors: threatened, migratory, or local marine fauna (marine mammals, marine turtles, sharks, rays, other fish and invertebrates); socioeconomic and cultural features. Some of these marine species have cultural significance to First Nations persons either as a traditional food source or for other cultural reasons (as to which, see Sections 3.2.14.9 and 3.2.14.10).

A PMST search was undertaken for the 20 km noise assessment boundary around the OA as a conservative buffer. No additional threatened species and one additional migratory species—oceanic whitetip shark—were identified within the noise assessment boundary compared with the OA (Table 3-12). The 20 km noise assessment boundary intersects the flatback internesting BIA and habitat critical to the survival of the flatback and does not intersect any known marine mammal or bird BIA.

Marine fauna use sound in a variety of functions, including social interactions, foraging, orientation, and response to predators. Underwater noise can affect marine fauna in these ways:

- attraction
- disturbance, leading to behavioural changes or displacement to fauna. The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation
- disruption to underwater acoustic cues
- increased stress levels
- indirectly by inducing behavioural and physiological changes in predator or prey species
- localised avoidance
- injury to hearing or other organs; hearing loss may be temporary (TTS) or permanent (PTS)
- masking or interfering with other biologically important sounds (including vocal communications, echolocation, signals and sounds produced by predators or prey).

The nature and scale of impacts must be considered in the context of the ambient noise environment. Ambient underwater noise levels depend on location, and are often dominated by local wind noise, waves, biological noise and vessel traffic. Wind speed and seabed conditions have a clear influence on the ambient noise level. Fish choruses are capable of reaching very high levels, in excess of 130 dB re 1 µPa (McCauley, 2012). Anthropogenic

underwater noise sources in the region comprise shipping and small vessel traffic, petroleum production and exploration drilling activities and sporadic petroleum seismic surveys.

Marine fauna respond variably when exposed to underwater noise from anthropogenic sources, with effects depending on various factors, including distance from the sound source, water depth and bathymetry, the animal's hearing sensitivity, type and duration of sound exposure and the animal's activity at the time of exposure. Broadly, the effects of sound on marine fauna can be categorised as:

- Acoustic masking – anthropogenic sounds may interfere with, or mask, biological signals, therefore reducing the communication and perceptual space of an individual. Auditory masking impacts could occur when audibility is reduced for one sound (signal) that is caused by the presence of another sound (noise). For this to occur, the noise must be loud enough and have a similar frequency to the signal, and both signal and noise must occur at the same time.
- Behavioural response – behavioural impacts will depend on the audible frequency range of each potential receptor in relation to the noise frequency—marine animals will only respond to acoustic signals they can detect, as well as the noise intensity. The intensity of behavioural responses of marine mammals to sound exposure ranges from subtle responses, which may be difficult to observe and have little implications for the affected animal, to obvious responses, such as avoidance or panic reactions. The context in which an animal receives the sound affects the nature and extent of responses to a stimulus. The threshold for eliciting behavioural responses depends on the received sound level and multiple contextual factors such as the activity state of animals exposed to different sounds, the nature and novelty of a sound, spatial relations between a sound source and receiving animals, and the gender, age, and reproductive status of the receiving animal.
- Physiological impacts – auditory threshold shift (temporary and permanent hearing loss) – marine fauna exposed to intense sound may experience a loss of hearing sensitivity or even potentially mortal injury. Hearing loss may be temporary (TTS) from which an animal recovers within minutes or hours, or permanent (PTS) from which the animal does not recover.

The levels of acoustic exposure that may result in injury or behavioural changes in marine fauna is an area of increasing research. Because of differences in experimental design, methods and units of measure, comparing studies to determine likely sound exposure thresholds can be difficult. After assessing the available scientific information, thresholds were defined to inform the impact assessment and interpret the estimated sound ranges. These are discussed for each receptor in JASCO (2020).

The assessment compared modelled received underwater sound levels to defined noise effect criteria, as determined by scientific research and academic papers (JASCO, 2020), for the identified environmental and social receptors. Although the relationship between received sound levels and impacts to marine species is the subject of ongoing research, the science underlying noise modelling is well understood (Farcas et al., 2016).

6.3.2.1 Marine mammals

There are no known BIAs for marine mammals within the 20 km noise assessment boundary (Table 3-13). Therefore, marine mammals are unlikely to aggregate within the noise assessment area, however, cetaceans and sirenians may transit the area. The closest significant feature to the noise assessment boundary are breeding dolphin BIAs—spotted bottlenose (Darwin Harbour stock), Australian humpback (a sub-species of the Indo-Pacific humpback dolphin; Darwin Harbour and Van Diemen Gulf stock) and Australian snubfin (Darwin Harbour and Van Diemen Gulf stock) which are greater than 46 km away from the OA (refer to Table 3-13). The nearest whale (pygmy blue) BIA (distribution) to the OA is greater than 300 km away (refer to Table 3-13).

The PMST report for the 20 km noise assessment boundary identified several threatened marine mammal species, including whales (blue, fin and sei) and migratory marine mammal species, including dolphins (Appendix D). A number of migratory species of whales may also occur within the noise assessment boundary, including humpback and Bryde's. These whales have been classified as LF cetaceans based on their hearing range. A number of odontocetes (including dolphins and killer whales) may also be transiting the noise assessment boundary and have been classified as high frequency (HF) cetaceans.

Dugongs are unlikely to occur within the noise assessment boundary, preferring shallow tidal and subtidal seagrass meadows. There are no assessments for impacts of vessel noise on dugongs (sirenians) using the Southall et al. (2019) criteria. As their frequency-weighting is most similar to HF cetaceans, and their thresholds are higher (as they are less sensitive), results for vessel noise impacts on HF cetaceans have been used as a proxy for those on dugong, noting that this is likely to be conservative.

The Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a), Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) and Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) list noise disturbance as a threat, specifically relating to impulsive sound sources, such as seismic surveys, and acute industrial noise, such as pile driving. Although seismic surveys and pile driving are outside the scope of this EP, survey activities are an impulsive sound source. Impulsive sound sources present a greater risk

than most continuous sounds because of the high peak levels and frequent repetition (CoA, 2015a). Shipping noise in busy shipping channels is also identified as a potential source of noise emissions, although the risk assessment determines that consequences would be restricted to individuals, and no population-level effects are expected. The Conservation Management Plan for the Blue Whale 2015–2025 requires that anthropogenic noise in BIAs will be managed such that any blue whales may continue to use the area without injury. Because the noise assessment boundary does not impact any blue whale BIA, impacts will be managed in adherence with the Management Plan (CoA, 2015a).

To better reflect the auditory similarities between closely related species, but also significant differences between species groups among the marine mammals, Southall et al. (2007) assigned the marine mammal species to functional hearing groups based on their hearing capabilities and sound production. This division into broad categories was intended to provide a realistic number of categories for which individual noise exposure criteria were developed. These groups were revised by National Marine Fisheries Service (NMFS) (2018) and most recently by Southall et al. (2019). The categorisation has proven to be a scientifically justified and useful approach in developing auditory weighting functions and deriving noise exposure criteria for marine mammals. These auditory weighting functions are referred to as frequency weighting.

For non-impulsive continuous noises, NMFS currently uses a step-function (all-or-none) threshold of 120 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (Table 6-5; NOAA, 2019). The behavioural disturbance threshold criteria applied uses the most recent scientific literature on the impacts of sound on marine mammal hearing, considered the most relevant to this activity.

Table 6-5 and Table 6-6 details marine mammal behavioural response, TTS and PTS thresholds for continuous noise (activity vessels) and impulsive noise (survey activities).

Table 6-5: Continuous noise: summary of marine mammals impact thresholds

Hearing group	NOAA (2019)	Southall et al. (2019)	
	Behaviour	PTS onset thresholds (received level)	TTS onset thresholds (received level)
	SPL (dB re 1 µPa)	Weighted SEL_{24h} (L_E^{46},24h; dB re 1 µPa²s)	Weighted SEL_{24h} (L_E^{46},24h; dB re 1 µPa²s)
LF cetaceans	120	199	179
HF cetaceans, including sirenians (dugongs)		198	178

Table 6-6: Impulsive noise: summary of marine mammals impact thresholds

Hearing group	NOAA (2019)	NMFS (2018); Southall et al. (2019)			
	Behaviour	PTS onset thresholds[47] (received level)		TTS onset thresholds[47] (received level)	
	SPL (dB re 1 µPa)	Weighted SEL_{24h} (L_E^{46},24h; dB re 1 µPa²s)	PK (L_{pk}[48]; dB re 1 µPa)	Weighted SEL_{24h} (L_E^{46},24h; dB re 1 µPa²s)	PK (L_{pk}[48]; dB re 1 µPa)
LF cetaceans	160	183	219	168	213
HF cetaceans, including sirenians (dugongs)	160	185	230	170	224

6.3.2.1.1 Potential impacts from activity vessels

Using the predicted noise levels (as described in Section 6.3.1.2), the estimated distances from activity vessels to behavioural and physiological thresholds (as listed in Table 6-5) for marine mammals were calculated and are provided in Table 6-7.

Zykov et al. (2013) considers a range of modelling scenarios for pipelay and support vessels in 23 to 80 m of water, with sea floor surface geology consisting of sand and silt. The depths and geology are similar to those within OA,

[46] *LE denotes cumulative sound exposure over a 24 hour period.*

[47] *Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset.*

[48] *Lpk denotes peak sound pressure and is flat weighted or unweighted.*

and the sound speed profile is similar at the relevant shallow depths to that used in previous work for the Barossa Development (JASCO, 2016). The vessel referenced in Zykov et al. (2013) is the *Solitaire*, a similar vessel to the *Audacia*, likely to be used for this project.

The *Audacia* has a similar total installed thruster power to the Mobile Offshore Drilling Unit (MODU) (outside the scope of this EP) considered in McPherson et al. (2019), 35,000 kW compared to 30,400 kW. McPherson et al. (2019) consider the most recent criteria for potential physiological effects (Southall, 2019) (refer to Table 6-5) and the equivalent NMFS (2018) from vessels in water depths less than 600 m. Therefore, it has been considered where there are similarities to the sound sources for the Activity.

Table 6-7: Estimated distances to behavioural and physiological thresholds (as listed in Table 6-5) for marine mammals from vessels

Potential marine mammal receptor	Estimated distance (km)	Justification/ reference
PTS		
HF cetaceans, including sirenians (dugongs)	Not predicted to occur	McPherson et al. (2019), offshore support vessel under DP, MODU under DP
LF cetaceans	<110 m	McPherson et al. (2019), offshore support vessel under DP, MODU under DP
TTS		
HF cetaceans, including sirenians (dugongs)	<120 m	McPherson et al. (2019), offshore support vessel under DP, MODU under DP
LF cetaceans	<1.5 km	McPherson et al. (2019), offshore support vessel under DP, MODU under DP
Behaviour		
HF cetaceans, including sirenians (dugongs)	1.3 – 9.8 km	McPherson et al. (2019), offshore support vessel under DP (1.3 km) Zykov et al. (2013), pipelay vessel under DP in 80 m water (9.8 km)
LF cetaceans		

McPherson et al. (2019) demonstrate that in both the project location and for a reasonable surrogate using the latest criteria, PTS is not exceeded for HF cetaceans, including sirenians (dugongs).

Auditory masking impacts could occur when audibility is reduced for one sound (signal) that is caused by the presence of another sound (noise). For this to occur, the noise must be loud enough and have a similar frequency to the signal, and both signal and noise must occur simultaneously. Therefore, the closer the marine mammal is to the vessel and the more overlap there is with their vocalisation frequencies, the higher the probability of auditory masking. Thus, the potential for masking and communication impacts is classified as high near the vessel (within tens of metres), moderate within hundreds of metres, and low within thousands of metres (Clark et al., 2009).

Generally, the spatial and temporal scale of behavioural (such as avoidance) response effects on marine mammals would be limited to the localised area surrounding the proposed activity vessels (thousands of metres) and periods of intensified activities. Because the pipelay vessel slowly moves along the ~23 km DPD route at approximately 2 to 3 km per day and does not overlap any marine mammal BIA, significant effects at the population level are not expected—impacts will be managed in accordance with the Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a), Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) and Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c).

The Blue Whale Conservation Management Plan requires that “Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury, and is not displaced from a foraging area”. The potential for injury to blue whales associated with exceedance of PTS and TTS thresholds from vessel noise sources is limited to up to 2 km from Activity noise sources within the OA. Notably, the modelled exposure area for the SEL_{24} criteria represents an area within which the animals may be exposed to sound levels associated with impairment (PTS or TTS) if they remain within the ensonified area for a duration of 24 hours. The pygmy blue migration BIA is 300 km away km from the OA and the pygmy blue foraging BIA is approximately 890 km from the OA. As such, the Activity is not inconsistent with the requirements of the Blue Whale Conservation Management Plan.

As outlined in Table 6-7, marine sound generated from vessel activities can cause behavioural responses, such as avoidance, in marine mammals within 1.3 to 9.8 km of the pipelay vessel.

While it is considered unlikely that transiting individuals would remain in close proximity to the sound source, PTS could occur in LF cetaceans within close proximity (<110 m) of the vessel. TTS could occur up to 1.5 km away for LF cetaceans and within close proximity (<120 m) for HF cetaceans, including sirenians (dugongs).

The impact risk is further reduced as the pipelay vessel slowly moves along the DPD route at approximately 2 to 3 km per day. The likelihood of an individual remaining within the distances above for any length of time is highly unlikely.

6.3.2.1.2 Potential impacts from helicopters

Helicopter noise has been measured at a maximum received level of 109 dB re 1 µPa (SPL) and only detectable underwater for 11 to 38 seconds (based on transit speed), depending on water depth (Richardson et al., 1995). Therefore, the only credible impact would be behavioural impacts, limited to short term behavioural responses such as diving or increased swimming speed when the helicopter lands or takes off. Such impacts are considered unlikely to result in substantial effects to marine mammal populations or distribution.

6.3.2.1.3 Potential impacts from survey and positioning equipment

McPherson (2020) indicates that both peak and frequency-weighted SEL noise emissions from survey equipment such as MBES operating at 400 kHz or SBP are typically below sound levels that could result in LF and HF marine mammal TTS or PTS from either PK or SEL criteria (Table 6-6) in a horizontal direction. The threshold for behavioural disturbance (Table 6-6) could be exceeded within 120 m (McPherson, 2020).

SSS and MBES sound levels are outside the auditory range of LF species such as baleen whales (e.g. humpback and pygmy blue whales) but within the mid-frequency and HF cetacean marine fauna auditory range (e.g. sperm whales and dolphins). However, PTS and TTS thresholds for these species (Table 6-6) are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species, individuals are expected to be transitory only, displaying behavioural responses and moving away from the source before TTS and PTS thresholds are exceeded.

Measurements of vessel mounted SBP indicated that the threshold for behavioural disturbance could be exceeded up to 141 m (NOAA, 2021).

The source levels for the positioning equipment are below those for the MBES. As the MBES will not cause the thresholds for physiological impact to be exceeded (Table 6-6), neither will the positioning equipment. However, the threshold for behavioural disturbance (Table 6-6) could be exceeded within 40 m (McPherson, 2020).

Survey and positioning equipment could cause masking of vocalisations of cetaceans due to the overlap in the frequency range between signals and vocalisations. Masking will primarily apply to HF cetaceans, including sirenians (dugongs), with all signals above 2 kHz. Higher frequency sounds have limited propagation and attenuate rapidly, resulting in a relatively small area of influence. Therefore, the range at which masking impacts could occur would be limited to within hundreds of metres from the sound source.

Given that marine mammal presence is likely to be transitory in nature, the likelihood of an individual remaining within the distances above for any length of time is highly unlikely.

Studies of baleen whales' (e.g. humpback whales and blue whales) hearing apparatus suggest that their hearing is best adapted for LF sounds (Southall et al., 2019) with peak sensitivity range for humpback whales being <10 kHz. Behavioural avoidance of baleen whales may onset from 140 to 160 dB re 1 µPa (NOAA, 2019). Baleen whales display a gradation of behavioural responses to noise, suggesting that acoustic signals are audible to whales at considerable distances from the source, but indicate that whales are not disrupted from normal activities even during migration (Southall et al., 2007).

Given that survey equipment sound levels are typically below marine mammal TTS and PTS onset thresholds, and there are no significant feeding, breeding or aggregation areas for marine mammals within the noise assessment boundary, the likelihood of noise impacts associated with survey equipment are considered remote and limited to temporary behavioural impacts to individual fauna close to the sound source.

6.3.2.2 Marine reptiles

The 20 km noise assessment boundary intersects the flatback turtle internesting BIA (>800 km of coastline) and habitat critical to the survival of the flatback turtle. The flatback turtle peak internesting period occurs between June to September and low-density nesting occurs during the wet season. Notwithstanding, the OA represents a minute fraction of the NT-wide total areas of flatback turtle BIA (internesting) and habitat critical to the survival of flatback turtles (nesting) shown in Figure 3-12. Furthermore, as the OA is located in water depths greater than 50 m and has a lack of foraging habitat, the potential numbers of affected internesting turtles is expected to be limited. The OA may also be traversed by green, olive ridley, loggerhead, leatherback and hawksbill turtles nesting in other areas of northern Australia as marine turtle migratory pathways are largely restricted to the waters less than 100 m deep (Pendoley, 2022).

The Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) highlights noise interference from anthropogenic activities as a threat to marine turtles. The plan refers to vessel noise and the operation of some energy infrastructure as sources of chronic (continuous) noise in the marine environment, exposure to which may lead to the avoidance of important turtle habitat. The recovery plan notes there is limited information available on the impact of noise on marine turtles and that the impact of noise on turtle stocks may vary depending on whether exposure is short (acute) or long term (chronic). Turtles have been shown to respond to LF sound, with indications that they have the highest hearing sensitivity in the frequency range of 100–700 Hz (Bartol and Musick, 2003).

Finneran et al. (2017) presented revised thresholds for marine turtle injury and hearing impairment (TTS and PTS). Their rationale is that marine turtles have better auditory sensitivity at low frequencies and poor auditory sensitivity at other frequencies (Bartol and Ketten, 2006; Dow Piniak et al., 2012; Martin et al., 2012). Accordingly, TTS and PTS thresholds for turtles are likely more similar to those of fish than to marine mammals (Popper et al., 2014).

Studies show that marine turtle behavioural responses occur to received sound levels of approximately 166 dB re 1 µPa and that avoidance responses occur at around 175 dB re 1 µPa (McCauley et al., 2000). These levels overlap with the sound frequencies produced by activity vessels. Based on the limited data regarding noise levels that elicit a behavioural response in turtles, the lower level of 166 dB re 1 µPa from the National Science Foundation (NSF, 2011) is typically applied, both in Australia and by NMFS, as the threshold level at which behavioural disturbance could occur. The recommended criteria for continuous and impulsive sound sources for turtles are listed in Table 6-8 and Table 6-9.

Table 6-8: Continuous noise: criteria for vessel noise exposure for sea turtles

Potential marine fauna receptor	Popper et al. (2014)		Finneran et al. (2017) Weighted SEL_{24h} (dB re 1 μPa^2s)	
	Masking	Behaviour	PTS onset threshold	TTS onset threshold
Marine turtle	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low	220	200

Note: Relative risk (high, moderate, low) is given for animals at 3 distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres. Sound Exposure Level (SEL). Zero to peak pressure level (PK).

Table 6-9: Impulsive noise: criteria for impulsive noise exposure for turtles, adapted from Popper et al., 2014

Potential Marine Fauna Receptor	Masking	Behaviour	TTS	Recoverable Injury	Mortality and Potential Mortal Injury
Marine Turtle	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) High (I) Low (F) Low	(N) High (I) Low (F) Low	>210 dB SEL24h or >207 dB PK

Note: Relative risk (high, moderate, low) is given for animals at 3 distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

6.3.2.2.1 Potential impacts from vessels

Based on the criteria listed in Table 6-8, there is a low risk of acoustic injury to marine turtles from activity vessel noise. Behavioural changes, such as avoidance and diving, are only predicted for individuals near the activity vessels (high risk of behavioural impacts within tens of metres of a vessel and moderate risk of behavioural impacts within hundreds of metres of a vessel). There is a high risk of masking within hundreds of metres of the vessel and a moderate risk of masking within thousands of metres from the vessel. Turtles have not been shown to rely on sound for finding food or avoiding predators. Sounds potentially could be used by turtles in a social manner to synchronise activities during the nesting season (Ferrara et al., 2014); however, this has not been demonstrated for marine turtles. Turtle noises are relatively quiet (Ferrara et al., 2014) and thus would only have a limited range of detection by turtles even in ideal conditions, with masking from natural sounds likely. The impacts from masking are expected to be low. Such impacts are considered unlikely to affect marine turtle populations or distribution substantially.

6.3.2.2.2 Potential impacts from helicopters

Helicopter noise will be intermittent during the Activity and below the behavioural impact threshold (PTS and TTS). Impacts to marine turtles from helicopter noise are expected to be limited to short term behavioural impacts (i.e. diving or swimming rapidly) when the helicopter is taking off, based on measurements of helicopter noise

(Richardson et al. 1995). Such impacts are considered unlikely to affect marine turtle populations or distribution substantially.

6.3.2.2.3 Potential impacts from survey and positioning equipment

The sound levels of the acoustic survey and positioning equipment (Sections 6.3.1.4 and 6.3.1.5) are below those associated with the PK criteria for injury (PTS and TTS) (Table 6-9) beyond a few metres, and are low enough that SEL criteria will not be reached (McPherson and Wood, 2017).

Recoverable injury and TTS could occur within tens of metres applying the relative risk criteria from Popper et al. (2014) (Table 6-9). Behavioural changes, such as avoidance and diving, are only predicted for individuals in close proximity to the Activity vessels with acoustic sources on board (high risk of behavioural impacts within tens of metres of source and moderate risk of behavioural impacts within hundreds of metres of the source).

Turtles are unlikely to experience masking even at close range to the source. This is in part because the sounds from survey and positioning equipment are all outside of the hearing frequency range for turtles (approximately 50 to 2000 Hz, with the highest sensitivity to sounds between 200 and 400 Hz) (Bartol and Ketten, 2006; Yudhana et al., 2010; Lavender et al., 2012, 2014).

Impacts to marine turtles from underwater noise generated by survey and positioning equipment are considered unlikely to result in substantial impacts given that impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. Behavioural impacts are extremely unlikely due to the signals all being outside the hearing range for turtles, however if they do occur, they will be limited in extent.

6.3.2.2.4 Summary

Considering the offshore location and water depths of greater than 50 m within the OA, only individual turtles may be affected as they transit the area, and impacts from noise are not considered significant because:

- the 20 km noise assessment boundary intersects a minute fraction of the total area of flatback turtle internesting BIA (>800 km of coastline) and habitat critical to the survival of the flatback turtle
- there are no flatback turtle nesting sites within the noise assessment boundary
- vessel noise, and survey and positioning equipment are expected to be below the thresholds for PTS and TTS given the typical size of vessels used during the Activity and the slow vessel speeds within the OA; the received levels may result in behavioural impacts, but for a limited time and will not result in significant impacts
- individual marine turtles may traverse the 20 km noise assessment boundary but are unlikely to aggregate
- helicopter noise will be intermittent during the Activity and below the thresholds for behavioural impacts (PTS and TTS)
- following the impact thresholds outlined in Table 6-8 and Table 6-9, marine turtles are at low credible risk of mortality or permanent injury due to continuous noise sources, even near the source
- behavioural responses are expected to occur near the sources but will be limited to avoidance or a temporary change in swimming behaviour.

6.3.2.2.5 Sea snakes and crocodiles

There is limited information on the effects of noise on sea snakes and crocodiles. A current research project investigating the impacts of impulsive noise (based on seismic surveys, noting seismic surveys are outside the scope of this EP) found that the hearing sensitivity of sea snakes is similar to species of fish without a swim bladder. Therefore, it is considered that there is a moderate risk in the near and intermediate distances (which extend hundreds of metres) of behavioural impacts to sea snakes, with the impacts being limited to temporary avoidance of the area. There are no known studies that have investigated the effects of noise on crocodiles so the thresholds for turtles shown in Table 6-8 and Table 6-9 are considered applicable. Such impacts are considered unlikely to result in substantial affects to sea snake populations or distribution.

6.3.2.3 Sharks, rays and other fish

The PMST report for the noise assessment boundary identified a migratory species—oceanic whitetip shark—additional to the several sawfish, ray, shark and other fish species listed in the PMST report for the OA (Table 3-12; Appendix D). There are no known fish spawning or aggregation areas along the DPD route; however, individuals or schools may transit. The closest area that supports site attached fish is the Shepparton Shoal (1.1 km from the DPD route) and Afghan Shoal (20 km from the DPD route). No impacts to fish stocks are expected. The closest known fish BIA is approximately 460 km from the OA (whale sharks).

All fish species can detect noise sources, although hearing ranges and sensitivities vary substantially between species (Dale et al., 2015). Sensitivity to sound pressure in fish seems to be functionally correlated to the presence or absence of gas-filled chambers in the sound transduction system. These chambers enable fish to detect sound pressure and extend their hearing abilities to lower sound levels and higher frequencies (Ladich and Popper, 2004; Braun and Grande, 2008). Based on their morphology, Popper et al. (2014) classified fish into 3 animal groups comprising:

- fish with swim bladders whose hearing does not involve the swim bladder or other gas volumes
- fish whose hearing does involve a swim bladder or other gas volume
- fish without a swim bladder that can sink and settle on the substrate when inactive.

Thresholds for PTS and recoverable injury are between 207 dB peak and 213 dB peak (depending on the presence or absence of a swim bladder), and the threshold for TTS is 186 dB SEL_{cum} (Popper et al., 2014). Because there are no exposure criteria for sawfish, sharks and rays, the same criteria are adopted, although these species do not possess a swim bladder.

The criteria defined in Popper et al. (2014) for continuous (Table 6-10) and impulsive (Table 6-11) noise sources were applied when assessing impacts to sharks, rays and other fish.

Table 6-10: Continuous noise: summary of fish impact thresholds

Potential marine fauna receptor	Mortality / potentially mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Type 1 Fish: No swim bladder (particle motion detection); includes sharks and rays	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Type 2 Fish: Swim bladder not involved in hearing (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Type 3 Fish: Swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB SPL for 48 hours	158 dB SPL for 12 hours	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Fish eggs and fish larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

Source: Adapted from Popper et al., 2014

Note: Relative risk (high, moderate, low) is given for animals at 3 distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Table 6-11: Impulsive noise: summary of fish impact thresholds

Potential marine fauna receptor	Mortality / potentially mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Type 1 Fish: No swim bladder (particle motion detection); includes sharks and rays	> 219 dB SEL_{24h} or > 213 dB PK	> 219 dB SEL_{24h} or > 213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Type 2 Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL24h or > 207 dB PK	203 dB SEL_{24h} or > 207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Type 3 Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or > 207 dB PK	203 dB SEL_{24h} or > 207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	> 210 dB SEL_{24h} or > 207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Source: Adapted from Popper et al., 2014

Note: Relative risk (high, moderate, low) is given for animals at 3 distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

6.3.2.3.1 Potential impacts from vessels

Based on this study, vessel noise has a low risk of resulting in mortality for all fish types. The risk of recoverable injury to Type 1 and 2 fish is low but is moderate for TTS and behavioural impacts when fish are within tens of metres of an activity vessel (Popper et al., 2014). For Type 3 fish, recoverable injury and TTS could occur within 60 m of the source (McPherson et al., 2019), with a high risk of behavioural impacts occurring within tens of metres of an activity vessel (Popper et al., 2014). Masking could occur within thousands of metres under a worst-case scenario of vessel operations, but typically any effect will be limited to within hundreds of metres.

Whale sharks are not considered to be particularly vulnerable to noise-related impacts and are categorised as 'fish with no swim bladder' when determining impact thresholds. Whale sharks would be expected to show avoidance to vessel noise, although they are likely to tolerate low-level noise—whale sharks have been observed swimming close to energy industry platforms on WA's North West Shelf.

Any presence of fish within the OA is expected to be of a transitory nature only, with no sensitive or significant benthic features known to be present that would cause an aggregation of fauna. In addition, impacts to fish are not considered to have the potential to be significant because noise levels from helicopters and vessels that may cause behavioural responses are expected to be within a radius of a few hundred metres of the noise source.

6.3.2.3.2 Potential impacts from survey and positioning equipment

The criteria defined in Popper et al. (2014) for impulsive noise sources has been adopted (Table 6-11). Impulsive noises from survey equipment could result in physiological impacts to fish located within metres of the sound source, considering the results presented in Sections 6.3.1.4 and 6.3.1.5.

Behavioural impacts to fish from survey equipment noise could occur in individuals located within hundreds of metres of the source. None of the proposed equipment has energy below 19 kHz, and therefore it is unable to be heard by most fish, which further reduces the risk of impact (Ladich and Fay, 2013). The impact of masking is low at all ranges, apart from fish who specialise in pressure detection, which can be impacted in a moderate way at thousands of metres. However, as these signals are outside the hearing range of most fish in the region, the risk of impact is reduced.

Sharks are known to be highly sensitive to LF sounds between 40–800 Hz sensed solely through the particle-motion component of an acoustic field, Popper et al. (2014). Free ranging elasmobranchs (i.e. sharks) are attracted to sounds possessing specific characteristics – irregular pulse, broadband frequency and transmitted with a sudden increase in intensity (i.e. resembling struggling prey).

Impacts to fish are not considered to have the potential to be significant because noise levels from helicopters, vessels, survey or positioning equipment that may cause behavioural responses are expected to be within a radius of a few hundred metres of the noise source.

6.3.2.4 Invertebrates

6.3.2.4.1 Potential impacts from vessels

Benthic invertebrates are considered unlikely to be negatively impacted from noise generated due to their distance from vessel activities (i.e., water depth is greater than 50 m) or from other Activity sources (such as ROVs). There are no thresholds or guidelines regulating the exposure of marine invertebrates to underwater noise.

Stress responses to non-impulsive sound exposure have been documented for marine invertebrates. The worst-case consequence for individual animals can be expected to be moderate to major, but due to the limited spatial extent of the affected area, population consequences are considered to be minor.

There is no systematic information available if, and to what, extent marine invertebrates use acoustic cues to communicate with others of their species or their environment. Anecdotal information indicates no functional relevance of sound for these animals. However, vibration, such as ground-borne or near-field particle motion, can be assumed to have functional relevance—vibration can provide information about potential food availability or approaching predators. This information could potentially be masked by the noise/particle motion emitted by the vessels even though this effect would be limited to the direct vicinity of noise-generating sources. In the worst-case scenario, the consequence of acoustic/vibrational masking is considered to be moderate for individuals. A limited number of individuals are expected to experience this masking; thus, it would have a negligible effect at a population level.

Limited and inconclusive data are available on the potential for behavioural responses and noise-induced physical effects on marine invertebrates. Theoretically, behavioural responses as well as significant sensory impairment or injury can have moderate consequences for an individual. However, in the absence of conclusive scientific information on the scope of these effects and the animals' ability to compensate for them, it is impossible to assess the consequences of behavioural responses and noise-induced impairment or injury.

Plankton and pelagic invertebrates could drift close to high-energy noise sources (e.g., bow thrusters). However, any negative impacts that could occur would be restricted to within metres of the sound source, apart from physical

damage at that close range. At such a localised extent, noise impacts would be negligible at an ecosystem or population level.

6.3.2.4.2 Potential impacts from survey and positioning equipment

For impulsive noise and benthic invertebrates, the source is an important consideration in the assessment.

Any negative impacts on plankton and invertebrates that could occur would be restricted to within metres of the sound source. At such a localised extent, impacts would be negligible at an ecosystem or population level.

There are no thresholds or information available for assessing the potential impacts from HF sources such as MBES/SBES on either water column or benthic invertebrates. These sources are often used to assess and quantify plankton densities, including within McCauley et al. (2017), who used a Simrad EK60 echosounder operating at 120 kHz.

6.3.2.5 Socioeconomic

Impacts to socioeconomic receptors, including commercial fisheries, recreation and tourism are considered to be minor due to the localised and temporary noise levels and low socioeconomic activity levels expected within the noise assessment boundary.

6.3.2.6 Cultural features

No First Nations people feedback was provided about potential noise impacts to any geographically specific cultural features (excluding marine fauna species) during consultation (refer to Table 4-10). The potential impacts to cultural features from noise emissions are associated with any direct or indirect impacts to culturally significant marine fauna species (refer to Sections 6.3.2.1 to 6.3.2.4).

During consultation with Tiwi Clans for the D&C EP, concerns were raised about the potential impact from drilling noise emissions on their dreaming totems (including turtle totems).

Tiwi clients of the EDO also raised concerns about the potential impacts to marine life by noise from the drilling activity; and the potential impacts of loud noises and vibrations that could harm imunga (spiritual places that are often connected to other sites) and marine species, which could in turn harm Tiwi people. Other concerns were raised by Tiwi clients of the EDO in relation to potential impacts to the health of land and sea country which could in turn impact access to food through traditional hunting and fishing, and that if totemic species (e.g. turtles) are impacted by the drilling activity this could impact Tiwi people and make them sick.

As presented in Section 3.2.14, some First Nations peoples' cultural beliefs place significance on culturally important spiritual beings and the protection they afford First Nations communities from natural disasters and sickness. Santos recognises that some First Nations Relevant Persons fear sickness or other adverse effects from the actions of spiritual beings in response to impacts on the environment of sea country itself. Of direct relevance these sorts of Tiwi cultural and spiritual values were tested in the Federal Court and were found not to be consistently spread amongst relevant Tiwi Islanders and in any event did not represent a particular 'place' of cultural and spiritual significance.

Santos notes that existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016, the North West Cable System since approximately 2016 and the GEP since 2023. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of almost 900 offshore wells. There is no evidence to support actual adverse effects from the actions of spiritual beings in response to impacts on the environment from these activities.

Santos recognises the importance of cultural and spiritual beliefs to First Nations people. Santos recognises that some First Nations people remain concerned about the potential for adverse consequences to First Nations people and natural environment, that may arise as a result of disturbance from the Barossa Gas Project to spiritual dreaming and culturally important spiritual beings. Santos understands the spiritual protection believed to be afforded to the First Nations people is broadly maintained by protecting the features of the natural environment and through ceremonial practices alerting the spiritual beings to the presence of people travelling through country and the like (Corrigan, 2023).

Dr Corrigan (2024) documented input from Larrakia people and relevant First Nations persons from Belyuen and Wagait, who advised the presence of a range of ancestral beings and dreaming stories of relevance to the Darwin Harbour, surrounding seas and the DPD Project footprint. None of these cultural features are known to be associated with any specific or particular places in the DPD Project footprint, but rather have a more general association with the wider area, as well as having associations with particular and specific places outside of the DPD Project footprint. In this regard, Dr Corrigan identified the following recommendation, as put to him by First Nations people:

"*that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities throughout the DPD construction process...*" (Corrigan, 2024)

Santos considers that control measure based on Dr Corrigan's recommendations will allow intangible impacts and risks to be reduced to ALARP and an acceptable level and has adopted these recommendations as C6.2.10. Santos has also considered those concerns relating to potential noise impacts relating to other Barossa Gas Project EPs and where applicable additional EPOs, EPSs and CMs have been adopted.

6.3.2.7 Summary

The marine fauna impacts of the Activity will be limited due to the short-term nature of installation activities (~3 months) and the low sound levels generated by the Activity. Activity noise levels may cause marine fauna behavioural responses, such as avoidance, that are expected to be confined to the noise assessment boundary and concentrated within a radius of approximately 9.8 km to a few hundred metres of the noise source, depending upon the noise sources and operations.

No known marine mammal BIAs occur within the noise assessment boundary. A flatback turtle internesting BIA and habitat critical to survival occur within the noise assessment boundary. Due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline, a lack of foraging habitat and that no aggregations are expected, the potential numbers of affected internesting turtles are expected to be limited. Migratory and threatened fauna, including turtles are considered likely to be limited to transiting individuals due to the distance from the coastline, water depth and lack of foraging habitat within the OA.

Noise effects to fish of potential commercial value would be restricted to within hundreds of metres of the noise source.

Negligible effects to benthic invertebrates are expected, including those of commercial value.

6.3.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- No significant impacts to marine fauna from noise emissions [EPO-03]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-12 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-12: Control measure evaluation for noise emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.3.1	Avoid activities near cetaceans and turtles (isolation control)	Santos implements EPBC Regulations– Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles) where vessel crew act as marine fauna observers (MFOs) to reduce the risk of a collision with marine fauna (Section 7.3). Reduces potential noise impacts by maintaining a minimum separation distance between cetaceans and turtles and the activity vessel. It also reduces helicopter noise levels received at the sea surface during flight by maintaining a minimum separation distance	Operational costs to adhere to marine fauna interaction restrictions, such as vessel and helicopter speed and direction, are based on legislated requirements and must be accepted.	**Adopted** – Note, control measure is aligned with EPBC Regulations (Part 8).

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		between the cetaceans and the helicopter. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.		
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	Reduces noise emissions by ensuring contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.	Costs are expected as part of standard procedure.	**Adopted**
C6.2.5	Vessel planned maintenance system (administrative control)	Ensures equipment that generates noise is operating optimally and sound source levels are appropriately verified and within desired operating range.	Costs are expected as part of vessel maintenance requirements.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.2.10	Cultural heritage training and cultural ceremony (administrative control)	Santos has been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the GEP EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns.	Time and cost to work with First Nations communities.	**Adopted**
C6.3.2	A crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours (administrative control)	Improved ability to spot and identify marine fauna.	Operational costs to adhere to training crew members as MFOs and implementation.	**Adopted**
C6.3.3	Helicopter planned maintenance system (administrative control)	Ensures helicopter engine and equipment that generates noise is operating optimally and sound source levels are appropriately verified and within desired operating range.	Costs are expected as part of helicopter maintenance requirements.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Manage the timing of the Activity to avoid sensitive periods such as migration (whales), spawning (fish) or nesting (turtles) (administrative control)	Reduces potential impacts to fauna during key life stages.	Reduces the window of opportunity for undertaking the Activity.	**Rejected** – not considered necessary or feasible as primary noise is from vessel DP thrusters and engines. The OA does not overlap with any whale migration BIAs and therefore seasonal presence of species is not expected to be higher at certain times of the year. Additionally, given the low potential impacts to individual fauna including marine turtles, significant impacts to migratory or nesting behaviours are not expected, therefore, no impacts at a population level are predicted that would warrant altering the timing of the Activity.
N/A	Noise management plan (administrative control)	Impacts are predicted to be minor (e.g. potential temporary and minor behavioural changes); therefore, a noise management plan, and associated management controls, will have little or no benefit in terms of outcomes (i.e. reducing impacts further).	Personnel costs of preparing and reviewing the management plan.	**Rejected** – the Activity does not occur near any resting, foraging, calving or confined migratory pathway for protected cetacean species, therefore the cost associated with developing a management plan outweighs the little or no benefit for a short duration activity that has a minor impact (e.g. potential temporary and minor behavioural changes).
N/A	Verification of noise levels (administrative control)	Allow adaptive management controls to be implemented if impact is greater than expected. May help verify estimated potential noise impact zones.	Costs of deploying noise monitoring equipment and processing data. Field monitoring program not warranted where potential impacts are low risk.	**Rejected** the OA does not occur in any resting, foraging, calving or confined migratory pathway for protected marine mammal species. Very short-term presence of vessels (approximately 3 months' duration) would prevent noise verification being completed before the Activity is finished. Cost disproportionate to the increase in environmental benefit given that the rapid reduction in noise levels from vessels and the low-level behavioural response expected.
N/A	Helicopters will not land or take off if marine megafauna are present in the vicinity of an activity vessel (elimination control)	Reduces potential impacts to megafauna.	May impact safety during landing or take off.	**Rejected** – increased exposure risk to passengers. Risk of exhausting fuel supplies.

6.3.4 Environmental impact assessment

Receptor	Consequence level
Noise emissions	
Threatened, migratory or local fauna	While the level of noise expected from temporary and intermittent operational activities has the potential to cause physical injury to marine fauna, most species that may transit through the OA are expected to demonstrate avoidance behaviour if noise levels approach those that could cause pathological effects. Avoidance behaviour is likely to be localised (less than 1 km) within the area of the activity vessels (due to the small spatial extent of elevated noise) and temporary (duration of the activity vessels operating). Impacts to marine mammals from underwater noise generated by the Activity are considered unlikely to be substantial given that there are no significant feeding, breeding or aggregation areas in the vicinity of the OA. The closest marine mammal BIA is the dolphin breeding BIA, located approximately 46 km from the OA, outside the area predicted to exceed thresholds for behavioural, masking or physiological impacts. The nearest whale (pygmy blue) BIA (distribution) is greater than 300 km away. Any responses will be limited to transiting individuals, which is unlikely to result in substantial impacts to marine mammal populations or distribution. Behavioural impacts may include increased swimming speed, changes in dive behaviour or avoidance of the area. Such impacts would be temporary, with no significant impacts predicted to individuals or populations. Potential behavioural impacts from underwater noise will be limited to within 9.8 km of activity vessels. There is potential for TTS to occur within 120 m and 1,500 m from the source for HF cetaceans, including sirenians (dugongs) and LF cetaceans, respectively. The potential for PTS in LF cetaceans is estimated to be within 110 m of the source. Notably, the modelled exposure area for the SEL_{24} criteria represents an area within which the animals may be exposed to sound levels associated with impairment (PTS or TTS) if they remain within the ensonified area for a duration of 24 hours. Given the pipelay vessel will be travelling at approximately 2-3 km per day, the transitory presence of marine mammals and the absence of any areas important for critical behaviours (feeding, breeding or resting), significant impacts to marine mammals are not credible. Further, it is anticipated that individuals may show avoidance behaviour in response to the continuous noise sources before respective TTS and PTS thresholds are exceeded. Behavioural impacts to fish from survey equipment noise may occur in individuals located within hundreds of metres of the source. Survey equipment could cause masking of vocalisations of cetaceans, but would be limited to within hundreds of metres from the sound source. PTS and TTS thresholds for marine mammals are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species and significant distances to the nearest marine mammal BIA, individuals are expected to be transitory only, displaying behavioural responses, and moving away from the source, before TTS and PTS thresholds are exceeded. In the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2917b), noise interference to marine turtles depends on whether the exposure is short (acute) or long-term (chronic). The noise generated by the Activity is acute, with impacts restricted to localised changes in behaviour within hundreds of metres of the source. The 20 km noise assessment boundary intersects the flatback internesting BIA and habitat critical to the survival of the flatback. However, due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline, a lack of foraging habitat and that no aggregations are expected, the potential numbers of affected internesting turtles are expected to be limited. Potential impacts to marine turtles from underwater noise are considered unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to behavioural and masking impacts within a relatively small area of important turtle habitat. Noise effects to other marine reptiles are likely to be limited to individual marine turtles transiting the area within tens of metres of the sound source. Potential impacts to threatened or migratory sawfish, sharks, rays or other fish species are limited to the potential for avoidance behavioural responses within hundreds of metres of the source. Although there is the potential for TTS within this range, this is not expected due to noise avoidance behaviour. Impacts to fish are not considered to have the potential to be significant because noise levels from noise sources that may cause avoidance behavioural responses are expected to be within a radius of a few hundred metres of the noise source. Other protected species are not expected to be affected given their wide distribution (in the case of sea snakes, crocodiles and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (sawfish). For the above reasons, no substantial change to threatened and migratory species is anticipated that may: • lead to a long-term decrease in the size of a population • reduce the area of occupancy of the species • fragment an existing population into 2 or more populations

Receptor	Consequence level
	• adversely affect habitat critical to the survival of a species • displace threatened and migratory marine fauna from habitat critical to the survival of a species areas • disrupt biologically important behaviours of threatened and migratory marine fauna within BIAs • disrupt the breeding cycle of a population • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline • interfere with the recovery of the species. The consequence of noise emissions is assessed as II – Minor.
Physical environment or habitat	Not applicable – no impacts to physical environments or habitats from noise emissions are expected.
Threatened ecological communities	Not applicable – no threatened ecological communities have been identified in the area over which noise emissions are expected.
Protected areas	Not applicable – no protected areas have been identified in the area over which noise emissions are expected.
Socioeconomic receptors	The consequence of noise emissions on receptors is assessed as II – Minor. Impacts to fauna, including fish and other marine species is likely to be limited to temporary behavioural impacts within a 9.8 km radius around activities, and will not result in significant impacts to marine species at the individual or population level. Given the negligible consequence to marine species, subsequent impacts to commercial fish stock are not anticipated. Impacts to socioeconomic receptors, including commercial fisheries, recreation and tourism are considered to be minor due to the localised and temporary noise levels and low socioeconomic activity levels within the noise assessment boundary.
Cultural features	No First Nations people feedback was provided about potential noise impacts to cultural features during consultation. For assessment of impacts to marine species that are of cultural significance and/or represent a traditional food source for First Nations groups, refer to the assessment for threatened, migratory or local fauna. Santos notes that existing subsea infrastructure has previously been placed on the seabed in the region, such as the Bayu-Undan pipeline since approximately 2006, the Ichthys Pipeline since approximately 2016, the North West Cable System since approximately 2016 and GEP since 2023. The region also has a history of significant historic and ongoing industrial shipping, fish trawling activities and drilling of almost 900 offshore wells. There is no evidence to support actual adverse effects from the actions of spiritual beings in response to impacts on the environment from these activities. Notwithstanding, in response to the concerns raised by some First Nations people during consultation for the D&C EP and the GEP EP (noting no concerns were raised by First Nations people for this Activity during the development of this EP), a control measure (C6.2.10) relating to cultural heritage training and cultural ceremony was developed with input from Relevant Persons and acknowledges the recommendations by First Nations people as suggested to Dr Corrigan (Corrigan, 2024). Santos considers the adoption of C6.2.10 and EPO-14 practicable and appropriate.
Cumulative impacts	
There is a potential for cumulative vessel noise from the Activity and other marine users, such as fishing and shipping, in the surrounding area. However, is not anticipated that there will be any significant cumulative noise emission impacts from the Activity and other marine users due to the: • short-term nature of the Activity • offshore location of the OA • low sound levels generated by continuous vessel noise sources • activity vessel speeds will be limited to ≤8 knots • marine fauna are expected to be limited to transiting individuals • other marine user vessels are not expected within the 500 m exclusion zone of the pipelay and construction vessels and likely to be transiting. Therefore, negligible additive and cumulative noise effects are expected, and no change to the overall consequence level is expected to result.	
Overall worst-case consequence	II – Minor

6.3.5 Demonstration of as low as reasonably practicable

The use of vessels on DP, survey equipment, acoustic positioning and ROVs for the Activity are unavoidable as there are no other options for safe installation methods. The activity vessels are expected to produce similar noise emissions to other marine vessels that frequent or transit through the vicinity of the OA. The proposed management controls will verify that the activity vessels and subsea acoustic position systems are operating optimally; hence sound levels are expected to be within the normal operating range.

The sound levels generated by surveys are medium– to high–frequency and decay rapidly with distance travelled from the source, as demonstrated by Zykov (2013), with the furthest distance survey noise is expected to travel being hundreds of metres. Note that marine fauna affected in varying degrees by acoustic noise (i.e., marine mammals, marine reptiles, sawfish, sharks and fish) are all expected to avoid the source of noise and will unlikely remain within the ensonified area for a duration of 24 hours. Avoidance behaviours are likely to be from a small area and to be temporary.

Using helicopters to transfer personnel to and from activity vessels is necessary to allow operational activities to occur safely and effectively. Some personnel also need to be rotated to and from other locations, and a rapid method to transfer personnel is required in an emergency. A performance standard prohibiting helicopters from landing or taking off in the presence of marine megafauna would introduce an unacceptable risk to human life. Lastly, the use of additional vessels for crew transfer would also prolong the presence of noise generating sources (i.e. vessel engines and thrusters) within the OA.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

In relation to spiritual and/or cultural heritage beliefs and connections to sea country and related concerns of some First Nations people, Dr Corrigan reported the suggested that Santos consider engaging cultural monitors to provide guidance and advice on the protection and maintenance of the cultural and spiritual places and activities during the DPD construction process (Corrigan, 2024). For example, a common practice is the use of ceremonies to introduce activities or the presence of strangers to spiritual beings (refer to Section 3.2.14.11), this has been adopted in this EP where any First Nations Relevant Person has raised similar concerns, even if the concern was raised during consultation for the D&C EP and GEP EP and not expressly raised in relation to this EP. Santos has also been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the GEP EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns. Santos considers that the adopted control measure (C6.2.10) based on the Corrigan 2024 Report recommendations will reduce environmental impacts and risks to ALARP, as relevant to First Nations individuals who hold these concerns in relation to their beliefs.

The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.3.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from noise emissions is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-14, including: **Conservation Advice:** • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) **Recovery Plans:** • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) identifies noise interference as a threat to blue whales. No known BIAs for the pygmy blue whale occur within the noise assessment boundary.

	• Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) identifies noise interference as a threat to marine turtles. Recovery plans / conservation advice for other species that may occur in the noise assessment boundary do not identify noise emissions as a key threat or have explicit relevant objectives or management actions related to noise emissions. The noise assessment boundary does not overlap any AMP or protected area. The objectives and actions of these publications were considered during impact and risk assessments. For all the plans identified above, the objectives are achieved by adopting EPO-03 and the controls outlined in Table 6-12 are consistent with the objectives of the material listed above and Santos considers the impacts of noise emissions to be not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with EPBC Regulations Part 8. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback indicated no recommendations for revising the EPO, CMs or EPSs. However, feedback received during the development of other Barossa Gas Project EPs and the Corrigan 2024 Report has been considered and where applicable, additional EPOs, CMs and EPSs (e.g. EPO-14, C6.2.10 and C6.3.2) were adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with no additional control measures adopted.

The Activity will be conducted over a very short time period where it is anticipated that there is a relatively low probability of encountering significant numbers of noise-sensitive fauna. During pipelay activities, the pipelay vessel will be travelling at approximately 2 to 3 km per day, therefore vessel noise will not impact any one location for an extended duration.

Minimal behavioural changes are expected from all marine fauna in the noise assessment boundary, and therefore the minor impacts expected from these noise sources are considered environmentally acceptable. No long-term harm is expected to result to EPBC Act listed marine fauna during operational activities. Through adherence to Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003), which drives compliance with EPBC Policy Statement Part 8, and EPS6.3.2.1, whereby a crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours and the vessel master or crew act as wildlife observers, the Activity is considered acceptable to undertake in the area. In addition, no concerns from stakeholders have been raised to indicate that the Activity will have any unacceptable impacts to socioeconomic receptors as a result of noise. The noise generated from vessels, helicopters, survey equipment and acoustic positioning and the potential impacts are well documented. With the controls proposed including EPBC Regulations Part 8 (Vessels and Aircraft) and aligned with the applicable management actions outlined in relevant recovery plans and approved conservation advice, the potential consequences of impacts to noise-sensitive receptors in the area are assessed to be II – Minor and ALARP.

6.4 Light emissions

6.4.1 Description of event

Event	Light emissions will occur from activity vessels and other support (see Section 2.4). Activity vessels and other support will routinely use external lighting to facilitate navigation and safe operations at night. Lighting typically comprises bright white (i.e. metal halide, halogen, fluorescent) lights, and is similar to that used in other offshore activities in the region, including fishing and shipping. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012* (Cth). Activity vessels will be required to generate and use navigational lighting at night to indicate their position and they must indicate their limited ability to manoeuvre during operations under the *Navigation Act 2012* (Cth). Spot lighting may be used on an as-needed basis, such as when deploying or retrieving equipment. The ROV will be used during the activity and spot lighting will be used when it is working underwater. Lighting will typically comprise bright white (i.e. metal halide, halogen, fluorescent) lights. Lighting will be limited to that required for safety and navigational purposes on the activity vessels.
Extent	The light assessment boundary of 20 km from the source is considered representative of the extent of light exposure, in accordance with National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b). This additional 20 km buffer around the OA is the extent relevant to the impact assessment for planned light emissions. Cumulative modelling of 2 vessels working together indicates that light is predicted to reduce to below ambient levels at approximately 21.6 km and potential behavioural impacts to turtles is limited to 4.5 km (Pendoley, 2022).
Duration	Navigational, safety and task lighting is required on a 24-hour basis for the duration of the Activity (prior to the preservation period) being approximately 3 months, as described in Section 2.

6.4.2 Nature and scale of environmental impacts

Potential receptors: threatened, migratory or local fauna (marine mammals, marine turtles, sharks, rays, other fish and seabirds); socioeconomic; and cultural features.

To humans, light is visible between wavelengths of approximately 380–780 nanometres between the violet and red regions of the electromagnetic spectrum. In fauna it is visible between 300 and more than 700 nanometres, depending on the species. Some fauna do not see long wavelength red light at all, while others see light beyond the blue-violet end of the spectrum and into the ultraviolet (DCCEEW, 2023b). Therefore, the source of impact from light not only relates to the amount of artificial light, but also the types of light and the wavelengths that the different light types emit.

Activity vessels will have external lighting to provide a safe working environment and to comply with relevant maritime navigation requirements at night. Light from the larger construction vessels will be the most visible and therefore was used to determine the worst-case distance that light may be visible for activity vessels.

Figure 6-1 provides photographs of a typical pipelay vessel, *Audacia*, with lights on at dusk. Lights include:

- regular halogen light bulbs (60–75 watt) and fluorescent lights (18–36 watt) that illuminate various gangways throughout the vessel and will be on all night for safety reasons
- floodlights of various power ratings (250–500 watt) that illuminate working areas
- helideck lights including floodlights (35 watt) and LEDs (3 watt) that provide lighting for the helicopter platform during night-time operations. Such lighting is obligatory but the platform will only be lit for safe helicopter landing and take off activities (e.g. medivacs or inspections). This lighting will be turned off during normal operations at night that do not involve helicopters
- navigation LEDs, which are installed at various locations around the vessel and are obligatory
- search lights, which are very bright but used only in emergency situations; these are turned off under normal operation.

Figure 6-1: Photographs of a typical pipelay vessel at dusk

Light modelling was undertaken for construction vessels to predict the extent of biologically relevant light spill. Specifics of the respective vessels' lighting design and luminaire specifications were applied to the Illumina Artificial Light At Night (ALAN) model (Aubé et al., 2005). The Illumina model is a 3D model that accounts for both line of sight and atmospheric scattering, allowing the attenuation of light over distance and extent of light glow to be modelled.

Since light sources (i.e. individual luminaires) can be placed individually within the area of interest, the model can replicate specific lighting designs in terms of light type, spectral distribution, height and orientation of individual luminaires, including any shielding, thus increasing model accuracy. This information was extracted from lighting layout drawings and light manufacturer data sheets for a typical pipelay and construction vessel, *Audacia* and *Fortitude* respectively. The model assumed that all vessel lights were turned on (apart from search lights, which are only used in an emergency) with no additional shielding other than that provided by the vessel structures. It also assumed vessels were orientated north–south and that cloud cover was zero (no contribution of light from cloud reflectance). Model outputs are provided in radiance (W/m²/sr, where W = watts, m² = metres squared and sr = steradian). Also modelled was the cumulative assessment (combined light spill) of the construction and pipelay vessel working together.

In the absence of any published or generally accepted units of measure, or scale, for measuring the impact of artificial light at night on turtle hatchlings, moonlight was used as a proxy. Output from the light model (radiance, units of watts/m²/sr) was converted to units of full moon equivalents to provide biological relevance to the radiance output.

Table 6-13 presents potential impact criteria for marine turtles related to the proportion of radiance of a full moon. This was derived by Pendoley (2022) using their extensive experience observing marine turtles and how they respond to light in field settings. The range of moon brightness across a whole lunar cycle provides a realistic scale representative of ambient light levels to which turtle eyes are adapted. The scale is logarithmic to represent the nature of light decay with distance (a function of the inverse square law). At the lower end of the scale, the radiant output is equivalent to no light in the sky (a new moon) while the upper limit is equivalent to the brightness of 10 full moons.

Table 6-13: Artificial light impact potential criteria (marine turtles)

OFOV FME[49] ranges*	Impact potential to marine turtles
10 to 100	Light or light glow visible and impact likely
1 to 10	Light or light glow visible and impact likely
0.1 to 1	Light or light glow visible and behavioural impact possible, depending on ambient moon phase
0.01 to 0.1	Light or light glow visible but behavioural impact unlikely (i.e. not biologically relevant)
<0.01	Light or light glow is considered ambient and no impact expected

Source: Pendoley (2022)

**Where 10 equals the radiance of 10 full moons and 0.01 equals 100th the radiance of one full moon.*

Light emissions were predicted to reduce to below ambient levels (0.01 orientation field of view full moon equivalents [OFOV FME], or 1%, radiance of a full moon) at 14.8 km from the offshore pipelay vessel, 10.9 km from the construction vessel and 21.6 km when both vessels are together (Pendoley, 2022). There is predicted to be a potential for behavioural impacts to turtles (0.01–0.1 OFOV FME, or 10%, radiance of a full moon) within 3.3 km of the offshore pipelay vessel, 2.5 km of the construction vessel and 4.5 km when both vessels are together (see Table 6-14). The closest regionally significant flatback turtle nesting site is located at Cape Fourcroy on Tiwi Islands, NT (approximately 25 km from the OA). Light spill from pipelay activities will therefore not impact Cape Fourcroy, which is also outside the light assessment boundary.

Table 6-14: Distance of equivalent moon radiances from the source

Proportion of radiance of a full moon*	Distance from source (m)		
	Pipelay vessel	Construction vessel	Cumulative
10–100	<160	<126	<202
1–10	160	126	202
0.1–1	724	557	957
0.01–0.1	3,274	2,469	4,542
<0.01	>14,804	>10,949	>21,559

Source: Pendoley (2022)

** Where 10 equals the radiance of 10 full moons and 0.01 equals 100th the radiance of one full moon.*

Continuous lighting may result in localised alterations to normal marine fauna behaviours that can alter foraging and breeding activity. Marine turtle and seabird species have the greatest sensitivity to light. The combinations of colour, intensity, closeness, direction and persistence of a light source are key factors in determining the magnitude of environmental impact (Environmental Protection Authority WA [EPA WA], 2010).

A PMST search was undertaken for the 20 km light assessment boundary around the OA, as recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b). No additional species were identified within the light assessment boundary compared to the OA (Table 3-12). An internesting buffer BIA for flatback turtles and habitat critical to the survival of flatback turtles overlaps the light assessment boundary.

6.4.2.1 Marine mammals

Although no marine mammal BIAs occur within the 20 km light assessment boundary, cetaceans may travel through the area. The nearest breeding dolphin BIA—spotted bottlenose (Darwin Harbour stock), Australian humpback (a sub-species of the Indo-Pacific humpback dolphin; Darwin Harbour and Van Diemen Gulf stock) and

[49] *orientation field of view full moon equivalents*

Australian snubfin (Darwin Harbour and Van Diemen Gulf stock) are greater than 46 km away. The nearest whale (pygmy blue) BIA (distribution) is over 300 km away.

The PMST report for the 20 km light assessment boundary for the OA identified several EPBC Act listed threatened marine mammal species including blue, fin and sei whales and migratory marine mammal species including dolphins, humpback whale and Bryde's whale (Table 3-12). Light is not listed as a threat in the conservation advice or recovery plans, nor in the Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a).

Marine mammals are not known to be attracted to light sources at sea. Cetaceans predominantly use acoustic senses to monitor their environment rather than visual cues (Simmonds et al., 2004). However, light glow may act as an attractant to light-sensitive prey species (e.g. squid and fish) that may alter predator-prey dynamics, particularly in dolphins. The impact from light is considered negligible.

6.4.2.2 Marine reptiles

6.4.2.2.1 Marine turtles

The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) state that a 20 km buffer (based on sky glow) to important habitats for turtles should be applied when considering possible impacts. However, the demonstrated impacts on which this buffer is based were in response to light emissions associated with a liquefied natural gas (LNG) plant. The light modelling found that the spatial extent of a measurable change in ambient light from the pipelay and construction vessels is predicted to be approximately 14.8 km and 10.9 km, respectively (Pendoley, 2022). The cumulative impact of these vessels working together is predicted to reduce below ambient levels at approximately 24.6 km. Potential behavioural impacts to turtles is predicted within 3.3 km of the pipelay vessel, 2.5 km of the construction vessel and 4.5 km cumulative impact (Table 6-14) (Pendoley, 2022). These studies indicate that the spatial extent of a change to ambient light is less than the 20 km light assessment boundary used for impact assessment, based on the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b).

An internesting buffer BIA and habitat critical to the survival for flatback turtles overlaps the OA with no other turtle BIA or nesting habitat overlapping the light assessment boundary. Due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline, and a lack of foraging habitat, the potential numbers of affected internesting turtles is expected to be limited to a small number of individuals. Flatback turtles may transit the OA in higher numbers during the peak internesting period (June to September); however, they do not exhibit discrete nesting/hatching seasons. No evidence, published or anecdotal, suggests internesting turtles are impacted by light from either natural or anthropogenic sources, as they do not use light as a cue for this behaviour. Furthermore, nothing in their biology would indicate this as a plausible threat (Pendoley, 2019; Witherington and Martin, 2003). In addition, individual turtles (green, olive ridley, loggerhead, leatherback, hawksbill) may transit the OA to forage or migrate to suitable habitat (e.g. nesting beaches and shoals) that is outside of the OA. For the reasons set out above, similarly to interesting turtles, if individual turtles are present, light emissions from activity vessels are unlikely to be of concern.

Once hatchlings enter the ocean, they are thought to employ a survival strategy that involves rapid dispersal away from predator-rich nearshore habitats to reach deeper waters where they develop into juveniles. An internal compass is set while crawling down the beach, and wave cues are used to reliably guide them offshore (Lohmann & Lohmann, 1992; Stapput & Wiltschko, 2005). In the absence of wave cues, however, swimming hatchlings have been shown to orient towards light cues (Lorne & Salmon, 2007; Harewood & Horrocks, 2008), and in some cases, wave cues were overridden by light cues (Thums et al., 2013, 2016). Currents substantially influence the speed and direction of at-sea dispersal; the offshore trajectory of flatback hatchlings at Thevenard Island was displaced by tidal currents which ran parallel to the beach, an effect that increased as the hatchlings moved further offshore (Wilson et al., 2018).

However, when light was present, this effect was diminished, showing that hatchlings actively swam against currents and towards the light source, which slowed their offshore dispersal from 0.5 m/s when no light was present, to 0.35–0.44 m/s, depending on the type of light (Wilson et al., 2018). The mean swimming speeds of flatback hatchlings under natural light conditions (0.5 m/s) were similar to green turtle hatchlings (0.49 m/s) (Thums et al., 2016). The swimming speed of olive ridley hatchlings has not been measured; however, since they are smaller than flatback and green turtle hatchlings, swimming speeds are expected to be lower (Pendoley et al., 2020).

These results suggest that hatchlings can move in any direction when their swimming speed is greater than the speed of the nearshore current, although the speed at which currents can no longer be overcome is species-specific and related to swimming speeds. Wilson et al. (2018) reported that when flatback hatchlings were within 150 m of the beach, they were able to swim against currents up to 0.3 m/s, although 0.3 m/s was the maximum current speed recorded during the study. Therefore, whether flatback hatchlings can swim against stronger currents is currently untested. If an olive ridley hatchling has a similar response to light cues as flatback hatchlings, their smaller size suggests a reduced capability to swim against currents compared to flatback turtles.

The Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) highlights artificial light as a threat to marine turtles. Specifically, the plan indicates that artificial light may reduce the overall reproductive output of a stock, and therefore recovery of the species by:

- inhibiting nesting by females
- disrupting hatchling orientation and sea-finding behaviour
- creating pools of light that attract swimming hatchlings and increase their risk of predation.

The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings following their emergence from nests by light spill on beaches, although breeding adult turtles can also be disoriented (Longcore and Rich, 2016). The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) states that within 15 km of the nesting beach, light impacts may affect flatback hatchling behaviours. The nearest turtle nesting beach is approximately 25 km from the OA and modelling predicts that light spill at an intensity that could lead to turtle behavioural effects are possible at distances less than 3.2 km for the pipelay vessel, 2.4 km for the construction vessel, and 4.5 km for both vessels together (Pendoley, 2022). Therefore, impacts to hatchlings are considered unlikely.

In summary, vessel light emissions are not expected to impact nesting females or emerging hatchlings at nesting beaches since modelling predicts that light or light glow will not exceed intensities considered biologically relevant (Pendoley, 2022). Additionally, vessel light emissions are not expected to impact individual internesting turtles since there is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels.

6.4.2.2.2 Sea snakes

Studies have shown that sea snakes display varying responses to light. For example, Hydrophine species appear to be attracted to light and have been observed floating on the sea surface and swimming up to light (pers. comm. M. Guinea, Charles Darwin University, 2014). However, the Aispysurus species of sea snake do not appear to be attracted to light and are not seen on the surface at night (pers. comm. M. Guinea, Charles Darwin University, 2014). Most sea snakes are likely to be associated with the shoals and banks, with the closest being Shepparton Shoal (1.1 km from the DPD route) and Afghan Shoal (20 km from the DPD route). It is recognised that some individuals (Pelamis genus) may occur in the OA and may be attracted to the light from activity vessels; however, it is considered unlikely that they will stay within the area (pers. comm. M. Guinea, Charles Darwin University, 2014).

6.4.2.3 Sharks, rays and other fish

Fish at the surface of the water have the potential to be impacted by artificial light. The response of fish to light emissions varies according to species and habitat. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al., 2001), with traps drawing catches from up to 90 m away (Milicich et al., 1992). Lindquist et al. (2005) concluded from a study that artificial lighting associated with offshore energy industry activities resulted in an increased abundance of clupeids (herring and sardines) and engraulids (anchovies). These species are known to be highly photopositive. The artificial light serves to focus their marine plankton prey and consequently leads to enhanced foraging success.

Sharks and rays are not known to be significantly attracted to light sources at sea. However, they may be attracted to the fish that are attracted to the light. Given the transitory presence of the pipelay activity (pipelay vessel travelling at 2-3 km per day), short duration of the activities and absence of critical habitats within the OA light impacts will not result in population level effects and will not extend to any areas of biological importance for these species.

6.4.2.4 Seabirds and shorebirds

The National Light Pollution Guidelines for Wildlife recommended using a 20 km threshold, which provides a precautionary limit based on observed effects of sky glow on fledgling seabirds grounded in response to artificial light 15 km away (DCCEEW, 2023b). There is one listed threatened species—sharp-tailed sandpiper—protected under the EPBC Act and 3 listed threatened bird species protected under both the EPBC Act and TPWC Act that may occur in the area—eastern curlew, red knot and curlew sandpiper. Table 3-12 lists the migratory shorebird and seabird species that may occur in the area. Table 3-14 lists the relevant bird conservation advice within the light assessment boundary. None identify light as a threat, however, light pollution is identified as a low-risk threat in the Wildlife Conservation Plan for Seabirds (CoA, 2020). The 20 km light assessment boundary does not intersect any known bird BIAs or habitat critical area.

Seabirds and shorebirds may either be directly attracted by the light source or indirectly—structures in offshore environments tend to attract marine life at all trophic levels, creating food sources and providing artificial shelter for birds (Surman, 2002). Offshore light sources may also provide enhanced capability for seabirds to forage at night. Artificial light can disorient seabirds, disrupt natural foraging and migratory behaviours, and potentially cause injury through interaction with infrastructure. Species with a nocturnal component to their life history, such as fledging

shearwaters and noddies, are most vulnerable to negative effects of artificial light. However, the nearest wedge-tailed shearwater and common noddy BIAs are greater than 1,545 km and 700 km from the OA, respectively (Table 3-13), and the nearest breeding colony is further still. At these distances, fledglings are not expected to occur in the OA. Cannell et al. (2019) reported mean foraging trip distances for wedge-tailed shearwaters, during different stages of the breeding cycle, as ranging from 183 to 5,113 km. As such, activity vessels within the OA should not significantly impact foraging behaviour, given the large distances typically covered by breeding individuals and the relatively short-term nature of the Activity.

6.4.2.5 Protected and significant areas; socioeconomic receptors; and cultural features

The OA is approximately 43 km from the nearest protected area (Oceanic Shoals AMP), which is a submerged receptor outside the light assessment boundary. The Northern Prawn Fishery's medium- and high-intensity fishing areas will not be impacted by lighting from activity vessels.

No First Nations people feedback was provided about potential light impacts to cultural features (excluding marine fauna species) during consultation (refer to Table 4-10). The potential impacts to cultural features from light emissions are associated with the impacts to culturally significant marine fauna species (refer to Sections 6.4.2.1 to 6.4.2.4).

First Nations people maintain a continuing spiritual connection with sea country, including marine fauna species with cultural significance, such as totems or as a cultural food source. Impacts to fauna, including fish and other marine species, is likely to be limited to localised, temporary behavioural impacts and is unlikely to result in significant impacts to marine species at the individual or population level. Information provided by some Tiwi people during consultation for this EP and the D&C and GEP EPs, raised concerns about the potential impacts of lights on marine turtles from Barossa activities, and potential impacts to marine life generally, and that if totemic species (e.g. turtles) are impacted by the Barossa activities this can impact Tiwi people and make them sick. It is noted that Seagull Island is too distant (>100 km away from the OA) for marine fauna located there to be affected by the Activity.

Impacts to turtles from the Activity lighting are expected to be restricted to localised attraction and temporary disorientation, with no long-term or residual impact and no impact to nesting beaches given their distance from the OA. Given the minor consequence to culturally significant marine fauna, subsequent impacts to socioeconomic receptors including cultural features (e.g. culturally significant marine fauna) are not anticipated.

6.4.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- No significant impacts to marine fauna from lighting emissions [EPO-04]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-15 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-15: Control measures evaluation for light emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.4.1	The pipelay vessel will have an enclosed pipe welding deck (engineering control)	An enclosed pipe welding deck is highly effective in preventing light emissions from a highly lit working zone.	Negligible costs.	**Adopted**
Additional control measures				
C6.4.2	Vessel searchlights will only be operated in an emergency (administrative control)	Searchlights are the most significant source of light from activity vessels. Not operating these lights during planned activities will reduce light spill.	Negligible costs.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
C6.4.3	Lighting will be used as required for safe work conditions and navigational purposes HSE induction to crew includes minimising light emissions from vessel during night hours where possible. (isolation control)	Light spill from unnecessary lighting reduced, even further lowering the likelihood of impacts to fauna from project vessel lighting. Lighting is assessed to only provide necessary lighting for safety and navigation during the activity. Reducing the potential for additional light pollution to the environment, thus reducing the potential impacts to marine fauna.	Limited additional cost associated with compliance assurance only.	**Adopted**
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. HSE induction includes information for vessel crew to minimise light emissions during night hours, where possible.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.2.10	Cultural heritage training and cultural ceremony (administrative control)	Santos has been implementing cultural heritage training and ceremony in the course of undertaking activities authorised pursuant to the GEP EP since November 2023 with broad support of First Nations communities as a culturally appropriate practice and response to cultural concerns.	Time and cost to work with First Nations communities.	**Adopted**
N/A	Restrict pipe transfer operations to day light hours during peak hatchling emergence season (administrative control)	Potentially reduce the disturbance of turtle behaviours caused by artificial lighting. The nearest turtle nesting beaches are approximately 25 km from the OA. Therefore, no nesting habitat or flatback hatchling behaviours will be impacted.	Increased duration of the Activity, increased costs and schedule delays.	**Rejected** – no turtle nesting beaches are within the 20 km light assessment boundary. Adopting this control has no environmental benefit relative to hatchling emergence behaviours, as no impact to emerging hatchlings is predicted.
N/A	Manage the timing of the Activity to avoid sensitive periods (administrative control)	Potentially reduce the disturbance of turtle behaviours caused by artificial lighting. The nearest turtle nesting beaches are approximately 25 km from the OA. Therefore, no nesting habitat or flatback hatchling behaviours will be impacted. An internesting buffer for flatback turtles (BIA and habitat critical to the survival) overlaps the OA. However, due to the OA water depths (greater than 50 m), the BIA extending over more than 800 km of coastline, and a lack of foraging habitat, the potential numbers of affected internesting turtles is expected to be limited to a small number of individuals.	High financial costs resulting in schedule delays and potentially a split campaign.	**Rejected** – the OA is located where it is unlikely to cause an impact to turtle nesting or emerging or dispersing hatchlings; therefore, timing the Activity to avoid sensitive periods would not change the potential environmental impacts.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		Flatback turtles may transit the OA in higher numbers during the peak internesting period (June to September), however, do not exhibit discrete nesting/hatching seasons.		
N/A	Implement light management actions recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b), including: • switch off outdoor/deck lights when not in use • use existing block-out blinds on portholes and windows that are not necessary for safety or navigation at night • manage and report seabird interactions (administrative control)	Would result in reduced light spill from internal lighting onto the sea surface, potentially reduce overall light emissions, and reduce the consequence of any impact to any fauna interactions.	Cost of maintaining records and to train staff. Potential re-engineering of vessel (lighting management systems and blackout blinds).	**Rejected** – control considered unwarranted given that the closest turtle nesting beach or rookery is greater than 20 km away. Therefore, no change to the potential environmental impacts. 24-hour per day activities require a safe standard of lighting.
N/A	Change the wavelength of outdoor lights to avoid wavelengths within the peak sensitivity of turtles (substitution control)	Would reduce light emissions to the marine environment. The light modelling predicted that light or light glow will not exceed intensities considered biologically relevant to nesting females or emerging hatchlings at the closest nesting beaches (Pendoley, 2022).	High cost to change vessel lights. Navigational lighting colours are stipulated by law. Working and egress areas must be lit for health and safety requirements.	**Rejected** – the high financial cost would be grossly disproportionate to negligible environmental benefits (if any). Health and safety considerations, and maritime regulations, dictate lighting requirements.
N/A	Identify highest intensity lights and replace with luminaire types considered appropriate for use near marine turtle nesting habitat (substitution control)	Would reduce light emissions to the marine environment. Existing luminaries are not expected to impact turtles. Light modelling was conducted assuming all vessel lights were on, with no significant effect on overall light emissions identified.	High cost to change vessel lights. Navigational lighting colours are stipulated by law. Working and egress areas must be lit for health and safety requirements.	**Rejected** – the high financial cost would be grossly disproportionate to negligible environmental benefits (if any). Health and safety considerations, and maritime regulations, dictate lighting requirements.
N/A	Limit or exclude night-time operations (elimination control)	Would reduce light emissions to the marine environment.	The DPD will be laid using a continuous assembly pipe-welding installation method. Stopping pipelay at night would result in increased impacts in other areas (e.g. waste, air emissions) and risks (e.g. vessel collision, and unnecessary fatigue on the pipeline). It would also	**Rejected** – given that the minimal risk of impacts to turtles and seabirds occurring, this control was rejected as the cost, environmental impacts and safety risks of implementing far

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			significantly increase the installation schedule and project costs. A minimal level of artificial lighting would still be required on the vessels on a 24-hour basis for safety reasons.	exceed the benefit gained.
N/A	Restrict lighting to navigation lights only (administrative control)	Would reduce light emissions to the marine environment.	Working and egress areas must be lit for health and safety requirements.	**Rejected** – Health and safety considerations, and maritime regulations, dictate lighting requirements.
N/A	Use dark, matte surfaces on vessels (substitution control)	Would reduce reflection and scattering of light resulting in skyglow.	Additional cost to repaint surfaces. Some areas may require lighter surfaces to manage heat conduction for health and safety. Unlikely to result in a material light reduction.	**Rejected** – given the short duration of activities, the cost would be grossly disproportionate to negligible environmental benefits (if any). May compromise health and safety in some circumstances.

6.4.4 Environmental impact assessment

Receptor	Consequence level
Light emissions	
Threatened, migratory or local fauna	Sensitive receptors that may be impacted by light emissions include marine turtles, fish at the surface and seabirds. The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) recommends a 20 km threshold as a precautionary limit based on observed effects of sky glow on marine turtle hatchlings and fledgling seabirds. The 20 km light assessment boundary intersects the internesting BIA and habitat critical to the survival of the flatback. However, due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline, and a lack of foraging habitat, the potential numbers of affected internesting turtles is expected to be limited to a small number of individuals. Internesting female turtles are not expected to be impacted by light emissions from either natural or anthropogenic sources, as they do not use light as a cue for this behaviour. Light modelling predicted a potential for behavioural impacts to turtles within 3.3 km of the pipelay vessel, 2.5 km of the construction vessel and 4.5 km cumulative impact (both vessels working together). In addition, the light from the cumulative impact will reduce to below ambient levels within 21.6 km. Therefore, no nesting habitat will be impacted (the closest turtle nesting beach is approximately 25 km distant) or affect flatback hatchling behaviours. Impacts to turtles from operational activity lighting are expected to be restricted to localised attraction and temporary disorientation but with no long-term or residual impact. Considering the distance from the nearest nesting beach, the density of post-dispersal turtle hatchlings in the OA is considered low. It is considered that the Activity will not compromise the objectives set out in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b). Fish (including sharks) have been shown to be attracted to artificial light sources, but the Activity is unlikely to lead to large-scale changes in species abundance or distribution. Overall, a short-term localised increase in fish activity is expected to occur as a result of lighting from the Activity vessels, but with minor impacts to the local fish population. Therefore, impacts to transient fish will be limited to short-term behavioural effects with no decrease in local population size or area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle. There are no known BIA or nesting habitat for birds within the light assessment boundary. Considering the distance from the nearest wedge-tailed shearwater or noddy breeding colony, the potential density of wedge-tailed shearwater or noddy fledglings in the OA is considered low.

Receptor	Consequence level
	Therefore, night-time lighting from the Activity is expected to have a negligible potential to impact on breeding or fledging seabirds. The consequence level for threatened, migratory or local fauna is considered to be II – Minor.
Physical environment or habitat	Not applicable – no impacts to physical environments or habitats from light emissions are expected.
Threatened ecological communities	Not applicable – no threatened ecological communities identified in the area over which light emissions are expected.
Protected areas	Not applicable – the light assessment boundary does not intersect any protected areas.
Socioeconomic receptors	Impacts to fish stock are likely to be limited to localised, temporary behavioural impacts and will not result in significant impacts to fish at the individual or population level. Given the negligible consequence to fish species, subsequent impacts to commercial fishing (Section 3.2.13.1) are not anticipated. Lighting from activity vessels is not expected to cause an impact to other socioeconomic receptors other than to act as a visual cue for avoidance of the area (for safety purposes) by other marine users, including commercial fishers. The consequence level for socioeconomic receptors is considered to be I – Negligible.
Cultural features	For assessment of impacts to marine species that are of cultural significance and/or represent a traditional food source for First Nations groups, refer to the assessment for threatened, migratory or local fauna.
Cumulative impacts	
Cumulative light emissions are considered unlikely to occur due to the distance to land (greater than 25 km), the remote location of the OA and the 500 m exclusion zone that will be in force around the pipelay and construction vessels. Offshore lighting in the region is mainly associated with commercial shipping, although commercial fishing and recreational vessels also contribute to offshore lighting. The activity vessels will add to the overall amount of offshore lighting in the region for the duration of the Activity, however cumulative impacts from other marine users are not anticipated. The lighting control measures identified reduce the extent practicable and the potential for impacts to sensitive marine fauna.	
Overall worst-case consequence	II – Minor

6.4.5 Demonstration of as low as reasonably practicable

Artificial lighting is required 24 hours a day for operational and navigational safety during the Activity. All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.4.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from light emissions is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity was evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-14, including: • National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Seabirds (CoA, 2020). For all the plans identified above, the objectives are achieved by adopting EPO-04 and control measures outlined in Table 6-15, and Santos considers the impacts of light emissions to be not inconsistent with these recovery plans. Recovery plans / conservation advice for other species that may occur in the light assessment boundary do not identify light emissions as a key threat or have explicit relevant objectives or management actions related to light emissions. The light assessment boundary does not overlap any AMP or protected place. The objectives and actions of these publications were considered during impact and risk assessments. The controls outlined in Table 6-15 are not inconsistent

	with the objectives of the material listed above and Santos considers the impacts of light emissions to be not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with SOLAS and the *Navigation Act 2012* (Cth). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback indicated no recommendations for revising the EPO, CMs or EPSs. However, feedback received during the development of other Barossa Gas Project EPs and the Corrigan 2024 Report has been considered and where applicable, additional EPOs, CMs and EPSs (e.g. EPO-14 and C6.2.10) were adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP assessment conducted, with no additional control measures adopted.

Lighting on activity vessels is industry standard and is required to meet relevant maritime and safety regulations. The potential consequences of the anthropogenic light sources in the OA are considered to be negligible and restricted to short-term behavioural impacts on individual fauna that may be present in the OA during the Activity. The 20 km light assessment boundary intersects the internesting BIA and habitat critical to the survival of the flatback. However due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline and a lack of foraging habitat, the potential numbers of affected internesting turtles are expected be limited to a small number of individuals. There is predicted to be the potential for behavioural impacts to turtles within 3.3 km of the pipelay vessel, 2.5 km of the construction vessel and 4.5 km cumulative impact (both vessels working together). Therefore, no nesting habitat will be impacted (closest turtle nesting beach is approximately 25 km distant) or flatback hatchling behaviours affected. Light emissions from the activity vessels are unlikely to attract and/or affect the behaviour of large numbers of seabirds and the impact of lighting associated with the Activity to seabirds is considered minor. The potential consequence of light emissions on receptors is assessed as II – Minor. With the control measures in place, including compliance with navigational safety legislation, no significant impacts are expected. Therefore, the impacts of light emissions to the receiving environment are reduced to ALARP and considered acceptable.

6.5 Atmospheric emissions

6.5.1 Description of event

Event	Atmospheric emissions may occur from: • hydrocarbon combustion to operate the activity vessels and helicopters • operation of vessel incinerators. Activity vessels may use ozone-depleting substances (ODS), but in a closed rechargeable refrigeration system—there is no plan to release ODS to the atmosphere.
Extent	Localised: small quantities of generated gaseous emissions will, under normal circumstances, quickly dissipate into the surrounding atmosphere.
Duration	Intermittent vessel emissions for the duration of the Activity (prior to the preservation period) being approximately 3 months.

6.5.2 Nature and scale of environmental impacts

Potential receptors: physical environment (air quality); threatened, migratory or local fauna (seabirds); socioeconomic receptors; and cultural features.

The potential impacts from air emissions identified above include:

- deterioration of local air quality
- contribution to national GHG levels.

These impacts may in turn have indirect impacts on marine species and the environment to which First Nations people are connected.

The emissions from vessels include non-GHG emissions (such as sulphur oxides [SO_x] and nitrogen oxides [NO_x]) and GHG emissions (such as carbon dioxide [CO_2], methane [CH_4] and nitrous oxide [N_2O]).

Non-GHG emissions may result in a temporary, localised reduction of air quality. A reduction in local air quality could affect threatened, migratory or local fauna (seabirds), and the workforce. Atmospheric emissions may be harmful, odoriferous or aesthetically unpleasing.

Table 6-16 lists the direct GHG emissions associated with activity vessels, excluding incineration activities, during the Activity. The emissions associated with vessel-based incineration activities have been excluded from the total estimated direct GHG emissions given the ad-hoc, infrequent use of vessel incinerators over a very short duration and negligible volumes of GHG emissions that these will generate. Emissions from activity vessels were calculated based on forecast fuel usage using the National Greenhouse and Energy Reporting (NGER) Emissions and Energy Threshold Calculator 2022–2023[50]. The total estimated direct GHG emissions from activity vessels is approximately 7,734 t CO_2-e. The total annual Australian GHG emissions for the year from September 2022 to September 2023 are estimated by the Commonwealth Government to be 459.7 Mt CO_2-e (DCCEEW, 2024k). The direct emissions from the Activity are estimated to be less than 0.0001% of the total annual Australian GHG emissions.

Table 6-16: Estimated direct GHG emissions from activity vessels (t CO_2-e)

Vessel type	Approximate fuel usage (tonnes)	Conversion to kilolitres (kL)	GHG			Total estimated GHG emissions (t CO_2-e)
			CO_2	CH_4	N_2O	
Pipelay	541.2	629.3	1,698	2	10	1,710
Construction	835.5	971.5	2,621	4	15	2,640
Support and supply	1070.99	1245.3	3,360	5	19	3,384
Total	**2447.69**	**2846.2**	**7,679**	**11**	**44**	**7,734**

There is no material indirect GHG emissions associated with the Activity. Refer to Appendix C for additional information.

[50] https://www.cleanenergyregulator.gov.au/NGER/Forms-and-resources/Calculators

In the future Barossa Production Operations EP, Santos will present a GHG (scopes 1 to 3) emissions analysis for the 25-year lifecycle of the Barossa Gas Project, which will inform the environmental assessment of GHG emissions.

The OA is in an offshore environment where there are no other permanent sources of air pollution—the air quality is expected to be nearly pristine. Atmospheric emissions from combustion engines could result in deterioration of local air quality, while direct GHG emissions may cause an incremental increase in global GHG concentrations, subject to numerous other factors and variables.

GHG emissions refers to gases that trap heat within the atmosphere through the absorption of long-wave radiation reflected from the Earth's surface. The emissions of CO_2, N_2O and CH_4, as relevant to this petroleum activity, are recognised as GHG emissions. GHG emissions are linked to global warming and climate change.

Santos recognises the science of climate change and supports the objective of limiting global temperature rise to less than 2°C and pursuing efforts to limit the temperature rise to 1.5°C. In recognition of the global need to reduce GHG emissions, Santos has had a published Climate Change Policy since 2008, guiding emissions management and climate change risks. The *Climate Change Act 2022* (Cth) legislates Australia's emissions reduction targets, including reducing Australia's net GHG emissions to 43% below 2005 levels by 2030 and the requirement for a multi-year emissions budget from 2021 to 2030, which has been set at 4,353 Mt CO2-e (Climate Change Authority, 2023). They form part of the Nationally Determined Contributions to the United Nations Framework Convention on Climate Change to meet Australia's net zero emissions by 2050 commitment (DCCEEW, 2023d).

Santos' emission reduction targets include a new long-term target of achieving net–zero scope 1 and 2 absolute emissions by 2040. Santos' strategy focuses on natural gas as a reliable transition fuel source and on developing technologies such as carbon capture and storage and alternative fuels, such as hydrogen and e-methane, as foundations for its decarbonisation pathway.

Potential impacts as a result of climate change have been modelled by the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The modelling indicates that temperatures will increase across Australia; rainfall patterns will change significantly; and extreme events, such as droughts, floods and wildfires, will become more common. These changes are likely to impact individual species, ecosystems and ecosystem services, such as food and water availability. Within decades, Australia will experience ongoing changes to its weather and climate (CSIRO and Bureau of Meteorology, 2022).

To date, the currently observed global warming and associated anthropogenic climate changes cannot be directly attributed to any one development or activity—they are the result of net global GHG emissions and GHG sinks that have accumulated in the atmosphere since the industrial revolution began in the 1700s.

Therefore, it is not possible to directly attribute any one project or activity, such as the Activity, to climate change impacts globally or upon potential Australian receptors due to the spatial (global) and temporal (since the industrial revolution) extent of GHG emissions. Therefore, consideration for the purpose of this EP is framed by the contribution that this petroleum activity will make to national and global atmospheric emissions of GHG. This contribution is small—less than 0.0001% of the annual Australian GHG emissions (2022–2023 data).

Further, the Barossa Development will be a designated large facility under the NGER Act and as such will be subject to the Safeguard Mechanism. This means that Santos, among other things, will have an obligation to ensure that the net covered emissions of GHGs from the operation of the Barossa Development do not exceed the applicable baseline.

ODSs are used in closed refrigeration systems. ODSs have the potential to contribute to ozone-layer depletion if accidentally released to the atmosphere. ODS air emissions would only occur in the event of damaged or faulty refrigeration equipment, or due to human error.

6.5.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- Reduce impacts to air quality (GHG and non-GHG emissions) from combustion engines and incinerators by maintaining atmospheric emissions in accordance with standard maritime practices [EPO-05].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-17 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-17: Control measures evaluation for atmospheric emissions

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.5.1	Atmospheric (GHG and non-GHG) emissions from combustion managed in accordance with standard maritime practice (administrative control)	Vessels, as required by vessel class, will comply with the *Navigation Act 2012* (Cth) and Marine Order 97 (MARPOL Annex VI) to meet the following requirements: • use low-sulfur fuel to reduce emissions • hold a valid International Air Pollution Prevention Certificate (or equivalent) • minimise the risk of accidentally releasing ODSs • minimise incinerator emissions.	No additional costs, as this is an industry standard requirement.	**Adopted**
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	Reduces emissions by ensuring contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.	No additional costs, as this is an industry standard requirement.	**Adopted**
C6.2.5	Vessel planned maintenance system (administrative control)	Reduces emissions by ensuring vessels are operating within desired operating range.	No additional costs, as this is an industry standard requirement.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	No incineration during activities (all waste transported to shore for disposal) (elimination control)	Eliminates waste incineration emissions.	Increase in health risk from storage of some wastes. Energy/emissions impacts to transfer waste for onshore disposal. Cost of waste disposal.	**Rejected** – avoiding incineration will increase cost and environmental impacts (emissions, energy and landfill) of onshore disposal.
N/A	Use incinerators and engines with higher environmental efficiency (administrative control)	Improves air quality by more efficient burning or fuel combustion.	Significant cost in changing vessel equipment.	**Rejected** – cost grossly disproportionate to low environmental benefit (impact rated Negligible).

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Removal of all ODS-containing equipment (elimination control)	Eliminates potential of ODS emissions occurring.	ODS is rarely found on vessels and there is a low potential for ODS releases. If there is ODS-containing equipment (such as refrigerators), it will be managed as per Marine Order 97: Marine Pollution Prevention – Air Pollution.	**Rejected** – based on cost to replace all equipment and the low potential for ODS releases.
N/A	Alternative fuel type selected for vessels (substitution control)	Could reduce pollutants associated with MDO combustion.	Not practically feasible at present. Practical and reliable alternative fuel types (and power sources) have not been identified for the contracted vessels required for this activity.	**Rejected** – not practically feasible at present. The contracted vessels are specialised and have limited availability. The vessels selected will comply with Santos' vessel vetting process.
N/A	Using lower emissions vessels (substitution control)	Reduces total emissions associated with engines.	Not practically feasible at present. The contracted vessels required are specialised and have limited availability. The vessels selected will comply with Santos' vessel vetting process.	**Rejected** – not practically feasible at present. The contracted vessels are specialised and have limited availability. The vessels selected will comply with Santos' vessel vetting process.
N/A	Santos vessel vetting process to include evaluation of vessel emissions and alternative fuels (administrative control)	Potential to reduce emissions associated with vessels by selecting more efficient vessels.	The emissions profile of activity vessels is not practicable as a factor for selection, given the limited vessel availability and limited emission variability between activity vessels currently available for hire. The vessels selected will comply with Santos' vessel vetting process.	**Rejected** – not feasible.
N/A	Reporting of GHG emissions as per the NGER Scheme (administrative control)	This is a regulatory requirement under the NGER Act with which Santos and its contractors must comply.	Cost associated with implementing.	**Adopted** – NGER reporting is a Commonwealth regulatory requirement, hence no control measure has been developed for this requirement.

6.5.4 Environment impact assessment

Receptor	Consequence level
Atmospheric emissions	
Threatened, migratory or local fauna	Short-term behavioural impacts (e.g. avoidance) to seabirds could be expected if they fly in the vicinity of the location. No decrease in local population size or area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle. The consequence level for threatened migratory or local fauna (seabirds) is considered to be I – Negligible.
Physical environment or habitat	The activity vessels and other supports will generate atmospheric emissions in the open ocean and offshore waters, enabling emissions to dissipate into the surrounding atmosphere quickly. GHG emissions released during the Activity will account for less than 0.0001% of annual Australian GHG emissions. Given the relatively small quantity, detectable environmental impacts are not predicted. The consequence level for physical environment/habitat is assessed as I – Negligible.
Threatened ecological communities	Not applicable – no threatened ecological communities were identified in the area over which air emissions are expected.
Protected areas	Not applicable – no protected areas over which air emissions are expected.
Socioeconomic receptors	Given the negligible consequence to species, subsequent impacts to socioeconomic receptors are not anticipated. As the Activity occurs in offshore waters, the air quality in coastal towns or settlements will not be affected. The consequence level for socioeconomic receptors is considered to be I – Negligible
Cultural features	For assessment of impacts to marine species of cultural significance, refer to the assessment for threatened, migratory or local fauna. For assessment of impacts to the physical environment to which First Nations people are connected and have raised concerns, refer to the assessment for the physical environment/threatened ecological communities/protected areas.
Cumulative impacts	
Cumulative atmospheric emissions with other marine users are unlikely to be significant. This is based on the following: • atmospheric emissions from vessels result in a localised reduction in air quality in the immediate vicinity of the source and hence are unlikely to overlap with other marine users due to the exclusion zones around the pipelay and construction vessels, and the remoteness of the OA. • the addition of atmospheric emissions from the activities will be a negligible contribution to overall Australian GHG emissions. Therefore, no change to the overall consequence level due to cumulative impacts has resulted.	
Overall worst-case consequence	I – Negligible

6.5.5 Demonstration of as low as reasonably practicable

Atmospheric emissions are largely unavoidable due to operational and health and safety considerations. All reasonably practicable control measures were reviewed and those adopted are considered consistent with maritime/energy industry standards and appropriate to manage the impacts such that the residual consequence is assessed to be I – Negligible. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.5.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from atmospheric emissions is I – Negligible.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD. Santos concludes that the Activity-related impacts of atmospheric emissions will not compromise the health, diversity or productivity of the environment.

Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes –maximum consequence from atmospheric emissions is I – Negligible. The Marine Bioregional Plan for the North Marine Region (CoA, 2012a) includes consideration of the effects of air quality on species. The implementation of EPO-04 and the control measures outlined in Table 6-17 will ensure the atmospheric emissions from the Activity (vessel emissions) will not compromise this conservation effort.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with the *Climate Change Act 2022* (Cth), *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (Cth) (and associated regulations), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (and associated regulations), and MARPOL VI/Marine Order 97. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – no objections or claims were specifically raised for this Activity. Existing control measures are considered appropriate to reduce impacts to ALARP.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, one additional control measure adopted.

Atmospheric emissions from vessels are permissible under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), which is enacted in Australian waters by Marine Order 97 (Marine pollution prevention – air pollution) (which also reflects MARPOL Annex VI requirements). This is an internationally accepted standard that is used industry wide, and compliance with Australian Marine Order standards is considered to be an appropriate management measure.

The consequence of atmospheric emissions on receptors is assessed as I – Negligible. Based on an assessment of Santos' acceptability criteria and with the control measures in place, there is expected to be no substantial change in air quality that may adversely impact the environment and the potential impacts are considered acceptable.

6.6 Vessel discharges

6.6.1 Description of event

Event	Potential impacts may occur in the OA from activity vessel discharges of: • deck drainage/run-off • sewage and greywater • food waste • cooling water • bilge water • brine (if a reverse osmosis unit is used for water treatment) • ballast water. The pipelay and construction vessels are the largest and primary vessels operating within the OA. While support and supply vessels may enter the area from time to time, they are likely to only be there for limited periods. As a result, it is reasonable to base the worst-case vessel discharge calculations on a total maximum POB of 552, assuming the pipelay (270 POB), construction (250 POB) and 2 supply (32 POB combined) vessels are in the OA concurrently. **Deck drainage** Drainage water from activity vessels includes rainwater, sea water and washdown water. Such discharge may potentially contain small residual quantities of oil, grease and detergents if present or used on the decks. Assessment of the unplanned spillage of hydrocarbons and other environmentally hazardous liquids is discussed in Section 7. **Sewage and greywater** The volume of sewage and greywater is directly proportional to the POB number. Up to 30–40 L of sewage/greywater may be generated per person per day. The estimated maximum sewage and greywater discharged is approximately 22,080 L/day. **Food waste** Putrescible waste potential discharge to sea is estimated to be approximately 1 L of food waste per person per day. The estimated maximum food waste discharged is approximately 552 L/day. **Cooling water** Sea water will be used as a heat exchange medium for cooling machinery engines. Sea water is drawn from the ocean and flows counter current through closed-circuit heat exchangers, transferring heat from engines and machinery to the sea water. The sea water is then discharged to the ocean (i.e. it is a once-through system). Cooling water temperatures may vary depending on engine workload and activity. **Bilge water** While in the OA, the vessels may discharge oily bilge water after treatment to 15 mg/L oil in water via an approved oily water filter system. **Brine** Brine generated from the water supply systems on each vessel will be discharged to the ocean at a salinity of approximately 10% higher than sea water. The volume of the discharge depends on the requirement for fresh (or potable) water and will vary between vessels and the POB number. The effluent may contain scale inhibitors to control inorganic scale formation, such as the formation of calcium carbonate and magnesium hydroxide, in water-making plants. Other water purification and plant cleaning chemicals may be used and discharged to sea after the cleaning process is completed. **Ballast water** Ballast water could potentially be discharged to the marine environment from vessel ballast tanks. Refer to Section 7.2 for the ballast water risk assessment. Note: Firefighting foam will not be discharged to sea when testing the firefighting system on vessels within the OA.
Extent	The small volumes of vessel discharges may cause localised nutrient enrichment, organic and particulate loading, ecotoxicological effects, and increased water temperature and salinity around discharge points and in the direction of the prevailing current. The environment that may be affected by vessel discharges is likely to be within approximately 50 m of the activity vessel and contained within the OA, based on dispersion modelling.
Duration	Discharges will occur periodically across the duration of the Activity (prior to the preservation period), being approximately 3 months, resulting in localised changes to water quality, but water quality conditions will return to normal within minutes to hours after ceasing discharges.

6.6.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality, benthic habitats), threatened, migratory or local fauna (marine mammals, marine turtles, rays, sharks and other pelagic fish, and seabirds); socioeconomic and cultural features.

6.6.2.1 Physical environment

Small volumes of vessel discharges will be released to the marine environment and result in a reduction in water quality. Discharges will be temporary (minutes to hours), localised and limited to surface waters. The discharges are expected to disperse and dilute rapidly.

Specifics of potential impacts to water quality from vessel discharges are as follows.

Eutrophication impacts from sewage, greywater and putrescible wastes

Discharges of macerated food waste, treated sewage and greywater can result in localised increases in nutrient concentrations (e.g. ammonia, nitrite, nitrate and orthophosphate), organics (e.g. volatile and semi-volatile organic compounds, oil and grease, phenols and endocrine-disrupting compounds) and inorganics (e.g. hydrogen sulfide, metals and metalloids, surfactants, phthalates and residual chlorine). Increased biochemical oxygen demand on the receiving waters may promote localised elevated levels of phytoplankton due to nutrient inputs and bacterial activity due to organic carbon inputs. This could subsequently impact higher order predators.

However, the discharges are low volume so their dispersion and dilution is expected to be rapid given the deep offshore waters dominated by high currents and strong wave action. The small volume and overall short duration of discharges are expected to disperse rapidly to levels below those which would cause adverse impacts.

The organic components discharged are subject to biodegradation through bacterial action, oxidation and evaporation. In a study of sewage discharge in deep ocean waters, Parnell (2003) reported no appreciable differences in the inorganic nutrient levels between the outfall area and background concentrations, suggesting rapid uptake of nutrients and/or rapid dispersion and dilution within hours of discharge.

Salinity increases

The desalination of sea water results in a discharge of brine with a slightly elevated salinity (around 10% higher than sea water). On discharge to the sea, the desalination brine, being of greater density than sea water, is expected to sink and disperse in the currents. The volume of the discharge depends on the requirement for fresh (or potable) water and the POB number.

Most marine species can tolerate short-term fluctuations in salinity around 20–30% (Walker and McComb, 1990), and it is expected that most pelagic species would be able to tolerate short-term exposure to the slight increase in salinity caused by the discharged brine.

Changes in temperature

Cooling water will be discharged at a temperature above ambient sea water temperature. Upon discharge it will be subjected to turbulent mixing and transfer of heat to the surrounding waters. Cooling water discharge to the marine environment could result in a localised and temporary increase in the ambient water temperature, which may cause alteration of the physiological processes (particularly enzyme-mediated processes) in marine biota.

Cooling water discharge points vary for each vessel. However, they all adopt the same discharge design, which permits cooling water to be discharged above the water line to help cool and oxygenate this wastewater stream before it mixes with the surrounding marine environment.

Contamination from releases of bilge water

Discharges of oily bilge water could result in a localised reduction in water quality with impacts on protected marine fauna and plankton, and has the potential to create an oil sheen on surface waters and a temporary localised decline in water quality and toxic effects to marine fauna. Toxicity to marine organisms would be from small amounts of dissolved hydrocarbons in the oily water drainage after treatment. Given that oil and grease residues in oily water drainage will be in low concentrations, the potential for impact is considered low and would be further reduced due to the strong tidal movements experienced in the region and the naturally turbid environment.

Toxicity

Discharges from vessels may include typical chemicals used within standard maritime sewage systems, desalination systems and residues of those used for cleaning decks. Discharges are expected to be intermittent and similar to other permitted discharges from vessels.

On discharge to the marine environment, the low volumes of these types of chemicals are expected to rapidly disperse in the offshore marine environment. There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the release.

Therefore, toxic environmental effects on environmental receptors along the food chain (plankton, fish, marine reptiles, birds and cetaceans) are not expected in these deep open waters.

6.6.2.2 Threatened, migratory or local fauna

As discussed in the sections above, the extent of impact for planned discharges is localised, and rapid dilution is predicted to occur within the offshore waters. An internesting buffer for flatback turtles (BIA and habitat critical to the survival) overlaps the OA. Due to the OA water depths (greater than 50 m), the BIA extending across more than 800 km of coastline, and a lack of foraging habitat, the potential numbers of affected internesting turtles is expected to be limited to a small number of individuals. Marine fauna within the OA, some of which may have cultural significance as totems or cultural food sources, are likely to be transient. If contact does occur with marine fauna, it will be for a short duration and likely not of sufficient duration to cause a toxic effect.

Discharges may cause changes to behaviour in marine fauna (avoidance or attraction). Fish and oceanic seabirds may be attracted to macerated food scrap discharges. However, such discharges would be isolated occurrences, so no prolonged influence on fauna behaviour is expected.

6.6.2.3 Cultural features

No First Nations people feedback was provided about potential impacts from vessel discharges to cultural features during consultations for the Activity.

Feedback provided during consultation on the D&C EP raised concerns regarding potential impacts from the Drilling Activity on totemic species and marine species that provide a food source for traditional fishing and hunting. Other Tiwi people also provided information to Santos that impacts to totemic species could also affect Tiwi people by making them sick. Section 6.6.2.2 describes the potential impacts to marine species of cultural significance.

6.6.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- Reduce impacts to water quality from activity vessel discharges by maintaining discharge streams in accordance with standard maritime practices [EPO-06]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-18 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-18: Control measures evaluation for vessel discharges

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.6.1	Routine discharges of treated bilge and deck water will comply with the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 91 (administrative control)	Managing bilge and deck drainage discharges to Commonwealth and marine requirements ensures no substantial change in water quality will occur. Ensures vessel oily water is treated and discharged in accordance with MARPOL Annex I (and Marine Order 91: Marine pollution prevention – oil).	MARPOL requirement.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
C6.6.2	Routine discharges of treated sewage and grey water, in accordance with the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 96 (Marine Pollution Prevention – Sewage) (administrative control)	Managing treated sewage and grey water discharges to Commonwealth and marine requirements ensures no substantial change in water quality will occur.	MARPOL requirement.	**Adopted**
C6.6.3	Routine discharges of putrescible waste, in accordance with standard maritime practice and Marine Order 95 (Marine Pollution Prevention – Garbage) (administrative control)	Reduces probability of garbage being discharged to sea thus reducing potential impacts to marine fauna and ensures compliance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage).	MARPOL requirement.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Zero discharge of deck water (elimination control)	Would eliminate potential contaminants being discharged to sea.	Increased safety risks from wet deck not draining. Large amounts of water on a vessel's deck can also cause stability issues (free surface effect).	**Rejected** – safety considerations outweigh the environmental benefit for a remote offshore location. The proposed discharges are permissible maritime discharges.
N/A	Zero discharge of bilge water (elimination control)	Would eliminate treated oily water from being discharged to sea.	Issues include vessel stability comprised, potential fire hazard and flooding risk.	**Rejected** – safety and environmental considerations outweigh the environmental benefit for a remote offshore location. The proposed discharge is a permissible maritime discharge.
N/A	Restrict use of desalination plant; or zero discharge of brine water (administrative control)	Would eliminate or reduce brine from being discharged to sea.	Cost associated with transporting freshwater offshore. Health risks associated with limited supply of freshwater. Storage of brine would create an additional hazard for working on deck.	**Rejected** – health and safety considerations outweigh the environmental benefit for a remote offshore location; use of 'water making' system and discharge of waste brine is a permissible maritime discharge.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Zero discharge of putrescible waste (elimination control)	Would eliminate putrescible waste from being discharged to sea.	This would result in an increase in environmental impacts through increased fuel consumption and increased atmospheric emissions, both by the vessel (or transport vessel) having to return to port a number of times to unload the wastes, and by land transport to the nearest disposal facility. Increased energy consumption and atmospheric emissions would also result from the disposal (e.g. incineration, treatment etc.) of the wastes.	**Rejected** – cost outweighs the benefit given the low impact expected from planned discharges; discharge of food waste is a permissible maritime discharge.
N/A	Mandatory closed drain system on vessels (administrative control)	Would eliminate untreated deck drainage from being discharged to sea.	Increased cost due to treatment system and vessel modification requirements.	**Rejected** – costs significantly outweigh the environmental benefit given the minor impacts expected from planned discharges.

6.6.4 Environmental impact assessment

Receptor	Consequence level
Vessel discharges	
Physical environment or habitat	Vessel discharges are predicted to quickly dilute and disperse in the offshore environment. Water quality impacts are anticipated to be localised and of short duration. Any effects on water quality are expected to be within the surface waters only and have no effect on seabed receptors. Given the nature of the planned vessel discharges, the limited volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OA, the consequence level for physical environment or habitat is considered to be II – Minor.
Threatened, migratory or local fauna	Sensitive receptors that may be impacted include plankton, fish at sea surface, marine turtles and mammals, and seabirds. Impacts to water quality will be localised and will occur only when the discharges occur (i.e. no sustained impacts), therefore recovery will be measured in hours Consequently, only short-term behavioural impacts are expected with no decrease in local population size, area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle. Given the nature of the planned vessel discharges, the limited volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment near the OA, the consequence level for threatened, migratory or local fauna is considered to be II – Minor.
Threatened ecological communities	Not applicable – no threatened ecological communities identified in the area over which vessel discharges are expected.
Protected areas	Not applicable – no protected areas were identified in the area over which vessel discharges are expected.
Socioeconomic receptors	Given the controls in place to manage the vessel discharges in accordance with regulatory requirements, impacts to marine species (including targeted fishery species) are not expected. Given the minor consequence to species, subsequent impacts to socioeconomic receptors including commercial fishing and cultural features are not anticipated. Vessel discharges will be of a relatively small scale and will be highly diluted. Therefore, the consequence to socioeconomic receptors (e.g. commercial fishing)f is assessed as I – Negligible.

Receptor	Consequence level
Cultural Features	For potential impacts to marine species of cultural significance or that provide a traditional food source, refer to the assessment for threatened, migratory or local fauna.
Cumulative impacts	
The offshore location of the OA and the 500 m exclusion zone around the pipelay and construction vessels means that it is unlikely that there will be a cumulative impact with other marine users. Therefore, no change to the overall consequence level due to cumulative vessel discharge impacts can reasonably be expected.	
Overall worst-case consequence	II – Minor

6.6.5 Demonstration of as low as reasonably practicable

Activity vessels are required to undertake the Activity.

Onboard treatment of most wastes and their subsequent discharge to the marine environment is consistent with legislative requirements (such as MARPOL) and considered environmentally acceptable.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual consequence is assessed to be II – Minor. The proposed control measures are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

6.6.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum planned vessel discharge consequence is rated II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the OA identifies habitat degradation / modification and pollution as a threat (Table 3-14): **Conservation Advice:** • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) • Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015f) • Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) • Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b) **Recovery Plans:** • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c). Recovery plans / conservation advice for other species that may occur in the OA do not identify habitat degradation / modification or pollution as a key threat or have explicit relevant objectives or management actions. The objectives of these publications were considered during impact and risk assessments. The controls outlined in Table 6-18 are consistent with the objectives of the material listed above. Santos considers the potential impacts from vessel discharges to be consistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Vessel discharges comply with the requirements of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), which in Australian waters reflects MARPOL, and is enacted by: • Marine Order 91 (Marine pollution prevention – oil) • Marine Order 95 (Marine pollution prevention – garbage) • Marine Order 96 (Marine pollution prevention – sewage).

Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback was considered and indicated no recommendations for revising the EPO, CMs or EPSs. However, feedback received during the development of other Barossa Gas Project EPs has been considered and EPO-14 was adopted. Santos has adopted control measure (C6.2.10) which was informed by Dr Corrigan's recommendations and the suggestions of a number of senior and authoritative Tiwi Islanders about culturally appropriate responses.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

The consequence of activity discharges on receptors is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

6.7 Activity discharges

6.7.1 Description of event

Event	Potential impacts may occur in the OA from activity discharges (excluding vessel discharges). Activity discharges include treated sea water and MEG discharges resulting from pre-commissioning activities, as well as grout from grout downline flushing (grout bag contingency option). Table 2-8 summarises the discharge volumes. Section 2.6 and Section 2.5.3.4 describes the activities leading to the discharge.
Extent	Activity discharges are expected to disperse rapidly and be diluted within the OA. If used, grout discharges will disperse as a fine sediment on the seabed within a few metres of the post-filled grout bags.
Duration	The total duration of activity discharges is nominally 7 days. Water quality changes are expected to recover within hours to days following cessation of discharges.

6.7.1.1 Treatment chemicals

As detailed in Section 2.11, all chemicals that are planned for discharge to the environment will be selected in accordance with a chemical selection process (see Section 2.11) to ensure that environmentally acceptable products are used or the risks can be demonstrated to be ALARP from the use of other chemicals.

The chemically treated sea water is typically a mixture of biocides (to prevent biofouling on the internal surfaces), an oxygen scavenger, corrosion inhibitor (to control corrosion of the pipeline), and a dye (allows for leaks to be detected through visual inspections). The typical dosage concentration is approximately 350 ppm (up to 550 ppm) using products (similar to Hydrosure or Roemex Hydro 3) that will be added to sea water for FCGT, dewatering, flushing and leak testing. An assessment determined that Hydrosure and Roemex Hydro 3 can be used interchangeably as their chemical composition and concentration profile is similar (see Section 2.11). For the purposes of this risk assessment, Australian marine species toxicity data for Hydrosure components were used (see Table 6-19). MEG will be discharge at a final purity of greater than 92% during the pre-conditioning and spool leak testing activities. Post-filled grout bags may be used in the unlikely event that a higher span rectification is required. The empty grout bags are filled from the surface using a liquid slurry of grout via a downline. After each operation, the downlines are flushed to subsea to ensure the grout does not set in the downline between filling operations.

Biocide

The biocide is an alkyl dimethyl benzyl ammonium chloride (ADBAC), which is a mixture of alkylbenzyl dimethylammonium chlorides of various alkyl chain lengths. It is a nitrogenous cationic surface-acting agent belonging to the quaternary ammonium group. The mechanism of microbicidal action is thought to be due to disruption of intermolecular interactions that cause dissociation of cellular membrane bilayers. This compromises cellular permeability controls and induces leakage of cellular contents.

ADBAC is reported to have a half-life of between 8 and 15 days in sea water and is considered highly biodegradable, which indicates that its potential persistence in marine water and sediments is unlikely.

Bioconcentration factor testing reported values for fish of 79 L/kg (CEFAS, 2017). Substances with a bioconcentration factor below 1,000 L/kg are considered to not bioconcentrate (Champion Technologies, 2013).

Industry alternatives to ADBAC are glutaraldehyde and tetrakis (hydroxymethyl) phosphonium sulfate. These alternatives were evaluated as more toxic to the marine environment and rejected.

Oxygen scavenger

The oxygen scavenger is ammonium bisulfite (NH_4HSO_3), a pale-yellow liquid with a pungent sulfur smell. It is soluble in water and readily reacts with oxygen to form sulfate salts and acids:

$$2NH_4HSO_3 + O_2 = (NH_4)2SO_4 + H_2SO_4$$

Neither the product component nor its by-products are classified as hazardous. It is listed in the OSPAR PLONOR list and therefore is considered safe to discharge to the marine environment.

Fluorescein dye

Fluorescein dye is a dark greenish liquid, a 60–90% aqueous solution of xanthene. Despite its significant visual effect in the water, it is not hazardous to the environment. The ecological information in the fluorescein Safety Data Sheet (SDS) states the product is not expected to be hazardous to the environment (Champion Technologies, 2011).

Solvents

Dipropylene glycol methyl ether and ethylene glycol (see also MEG below) are organic compounds used in various industrial products, including paints, pastes, dyes, resins, brake fluids, inks, and cosmetics.

Monoethylene glycol

MEG is a colourless, odourless, non-volatile, hygroscopic liquid. It is characterised by 2 hydroxyl groups, which contribute to its high water solubility, hygroscopicity and reactivity with many organic compounds. MEG is on the OSPAR PLONOR list and therefore is deemed safe to discharge to the marine environment.

MEG is soluble in water, does not volatilise or undergo photodegradation, and is not adsorbed on to soil particles (Hook and Revill, 2016). Studies on a green alga (*Chlorella fusca*), a freshwater crayfish (*Procambarus* sp.) and a golden orfe carp (*Leuciscus idus melanotus*) revealed low potential for bioaccumulation in the marine environment (International Programme on Chemical Safety, 2000). Ethylene glycols biodegrade readily when released to the environment, and several strains of microorganisms can use them as an energy source.

6.7.1.2 Grout

Post-filled grout bags may be used in the unlikely event that a higher span rectification is required. The empty grout bags are filled from the surface using a liquid slurry of grout via a downline. After each operation, the downlines are flushed to subsea to ensure the grout does not set in the downline between filling operations. The grouting operations may release up to 1.5 m^3 of grout per line with a maximum total volume 6 m^3. Grout is composed of cement, sand and water and is on the OSPAR PLONOR list. The fate of any grout released will not impact the seabed biota. As filling grout bags is a contingency activity and that grout is deemed safe to discharge to the marine environment, grout will not be discussed further in this assessment.

6.7.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality, benthic habitat); threatened, migratory or local fauna; socioeconomic receptors; and cultural features.

6.7.2.1 Ecotoxicity

Table 6-19 lists whole effluent testing results for Hydrosure, or its equivalent, that may be used to treat sea water for pre-commissioning activities. Testing was undertaken according to protocols recommended by the Australian and New Zealand Guidelines (ANZG) (2000) and included 5 locally relevant species from a range of trophic levels (primary producer, herbivore and carnivore). Note that the ANZG are now able to be accessed online and a 'conceptual model' process has been introduced so that community and local government thresholds are also included when selecting 'default guideline values'; this new process is unlikely to change the guideline values for Commonwealth Waters offshore marine water quality (ANZG, 2018). Results show that NOECs ranged from 0.13 ppm for the crustacean to 12.5 ppm for the fish. In general, simpler life forms (algae and species in their larval stage) exhibited higher sensitivity compared to more complex life forms such as fish.

Table 6-20 lists species protection levels calculated from the statistical distribution of the NOECs and the dilutions to achieve the NOEC threshold based on a dosage of 550 ppm.

For long-term continuous discharges (e.g. sewage outfalls), ANZG (2018) recommend that the 99% species protection concentrations (PC99%) should be applied to develop environmental criterion for high-conservation ecosystems. For chemicals with negligible potential for bioaccumulation, the 95% level of species protection (PC95%) may also be applied.

The NOEC thresholds are derived from long–term ecological tests whereby organisms are exposed for periods typically between 48 and 96 hrs. In this instance, the dose that environmental receptors shall receive will be less than those exposed in the toxicological tests due to the short release duration (35 hrs) and altering tidal directions. This resulted in concentrations not exceeding the conservative NOEC PC99% threshold of 0.06 ppm for a period where effects would be expected to be observed (>48 hrs). Hence, as an additional level of conservatism, the concentrations were examined over a 12-hour continuous duration. Consequently, the extent of the mixing zone was based on a PC99% NOEC threshold of 0.06 ppm over a 12-hour continuous duration.

Table 6-19: Ecotoxicological testing results for Hydrosure

Species	Test	Type	EC_{10} ppm	EC_{50} ppm	LOEC ppm	NOEC ppm
Nitzschia closterium (algae)	72-hour growth inhibition	Chronic	1.5 *	3.3 (3.0–3.58)	2.50	1.30

Species	Test	Type	EC_{10} ppm	EC_{50} ppm	LOEC ppm	NOEC ppm
Saccostrea echinata (mollusc)	48-hour larval abnormality	Chronic	0.29 (0.24–0.33)	0.54 (0.52–0.56)	0.50	0.250
Heliocidaris tuberculata (echinoderm)	72-hour larval development	Chronic	1.30 (1.27–1.32)	1.71 (1.70–1.74)	2.50	1.25
Melita plumulosa (crustacean)#	96-hour acute toxicity	Acute	0.08 (0.04–0.11)	0.14 (0.10–0.16)	0.25	0.13
Lates calcarifer (fish)#	96-hour acute toxicity	Acute	13.5 (12.3–18.0)	17.5 (17.1–18.0)	25.0	12.5

Source: Chevron (2015)
**95% confidence limits are not reliable; numbers in brackets represent the 95% fiducial limits.*
 # Toxicity test is defined as an acute test.

Table 6-20: Species protection concentrations for Hydrosure based on the NOEC from whole effluent toxicity testing

Species protection level	NOEC threshold (ppm)	Dilutions required to achieve the NOEC threshold based on Hydrosure dosing concentration of 550 ppm
PC99%	0.06	1:9,167
PC95%	0.10	1:5,500
PC90%	0.15	1:3,667
PC80%	0.23	1:2,391

Source: Chevron (2015)

6.7.2.2 Biodegradation and bioaccumulation potential

As described in Section 6.7.2.1, the constituent components of the treated sea water and MEG do not persist or accumulate within the marine environment. The mixture is therefore considered biodegradable with negligible potential for bioaccumulation.

6.7.2.3 Dispersion Modelling Parameters

RPS (2021) conducted near–field modelling using CORMIX and far–field modelling using MUDMAP. Table 6-21 summarises the treated sea water and MEG discharge configuration and properties used as modelling inputs. The hydrotest dosage rate modelled was 550 ppm; however, the expected dosage rate is 350 ppm. The treated sea water will have the same water temperature and salinity as the surrounding sea water (28.2°C and 34.6 psu, respectively) and therefore neutrally buoyant.

Table 6-21: Summary of treated sea water and MEG discharge model parameters

Parameter	Value/design
Total volume of treated sea water released	55,614 m³
Total volume of MEG released	1,000 m³
Discharge depth (m)	3.5 m above the sea floor
Discharge location	PLET (refer to Table 2-2 for coordinates)
Discharge duration	35 hours
Model run duration	3 days
Diffuser configuration	Three 4” ports spaced 4” apart and oriented 45º vertically upwards
Exit diffuser velocity (m/s)	21.3
Discharge temperature (°C)	28.2 – same as ambient
Discharge salinity (psu)	34.6 – same as ambient
Initial hydrotest concentration	550 ppm of Hydrosure

Along with the ambient water temperature and salinity, a range of current speeds were included in the near-field model. Table 6-22 lists the weak, moderate and strong current speeds from annualised seabed current data to reflect the potentially contrasting dilution and advection cases:

- weak current speed: 5th percentile (or 5% of the time the currents will be below the identified speed), low dilution and slow advection
- moderate current speed: 50th percentile (or 50% of the time the currents will be below the identified speed), average dilution and advection
- strong current speed: 95th percentile current speed (or 95% of the time the currents will be below the identified speed), high dilution and rapid advection to nearby areas.

The weak ambient currents (0.05 m/s) constitute the worst–case mixing conditions for the treated sea water release.

Table 6-22: Adopted annual seabed static current adjacent to the release location

Depth	Weak current speed (m/s)	Moderate current speed (m/s)	Strong current speed (m/s)
50	0.05	0.35	0.85

Twenty–five simulations were run with a different start time to provide a range of current conditions. Each simulation was run for an additional 38 hours after the cessation of the discharge. Once the simulations were complete, the results were overlayed to determine the potential area of exposure based on 12-hour continuous exposure periods.

6.7.2.4 Dispersion Modelling Results

The near-field results showed that the treated sea water would initially shoot upward at a 45º angle due to the diffuser orientation and the high exit velocities. The initial mixing that takes place will largely be due to the high exit velocities. Once the plume lost its momentum, the neutrally buoyant plume is predicted to travel laterally and disperse with the currents. The dominant role of tides in shaping the local currents is evident in the results, as the modelled plume bends and changes direction from north-west to south-east during the flood tide currents. The predicted concentrations during this period exhibit a decreasing trend as the distance from the release location increases.

To assess the toxicity of the effluent on relevant local species, Whole of Effluent Toxicity testing was conducted following the recommended protocols from ANZG (2000), as shown in Table 6-19 and Table 6-20. The predicted results of treated seawater dilutions were compared to NOECs for Hydrosure (Chevron, 2015), shown in Table 6-20. All results predicted that concentrations did not persist above NOECs for more than 48 hrs (which is the typical exposure period used to determine the NOEC).

Out of the 25 simulations conducted under different metocean conditions, one run (simulation 19) predicted a 4% probability of exposure at the PC90% NOEC threshold of 0.15 ppm exposure over a 12 hour continuous exposure period in the waters above the shoulder of Shepparton Shoal, located south of the release location. The modelled results are considered to be conservative given the dosage rate modelled was 550 ppm (maximum dosage rate); however, the expected dosage rate is 350 ppm. In practice, the Hydrosure concentration will biodegrade over time during the hydrotest and reduce in concentration within the pipeline. Therefore, it is expected that discharge concentrations will be less than that modelled, and mixing and dilution to the NOEC PC90% (and other mixing zone boundaries) will occur closer to the discharge point than indicated by the modelling outputs.

Figure 6-2 illustrates the predicted extent of the Hydrosure concentrations based on an amalgamation of all 25 simulations. The predicted maximum distance from the release location to the PC99% NOEC threshold of 0.06 ppm and PC95% NOEC threshold of 0.10 ppm was 7.23 km and 5.33 km, respectively. The maximum distance based on the PC80% NOEC threshold of 0.23 ppm did not exceed 0.2 km. The conservative area of exposure was predicted to be within 4.68 km^2 based on the PC99% NOEC threshold of 0.06 ppm and a 12-hour continuous exposure period.

Table 6-23: Summary of the predicted maximum distance and area of exposure from the release location for each species protection level derived from 25 simulations over 12-hour continuous exposure period

Initial chemical dosing (ppm)	Species protection level	Maximum horizontal distance from the release location (km)	Area of exposure (km^2)
550	PC99%	7.23	4.68
	PC95%	5.33	0.67
	PC90%	5.19	0.08
	PC80%	0.20	0.02

MEG is readily biodegradable and has low toxicity to aquatic organisms (WHO, 2000). A substantial database on its toxicity to aquatic organisms is reported by WHO (2000), with a predicted no effect concentration (PNEC) of 859 ppm. Assessment of the 1,000 m^3 neat MEG conditioning discharge at the discharge location has been undertaken using this value. RPS (2021) modelling results for the treated sea water discharge predict that dilutions of up to 10,000 (less than 0.06 ppm) are likely to be expected to occur at Shepparton Shoal (as represented by the dilutions required to meet the Hydrosure PC99% NOEC, see Table 6-20), representing a MEG concentration in the order of 100 ppm, which is well below the PNEC value of 859 ppm. Figure 6-2 illustrates the Hydrosure PC80% NOEC maximum distance (0.2 km) representing approximately 2,400 dilutions (see Table 6-20). Therefore, the MEG concentration at this boundary would be approximately 420 ppm and below the PNEC value of 859 ppm.

Given the expected low residual concentrations, rapid biodegradation and low toxicity of MEG, no significant impact from the release of MEG is expected to the marine environment and will not be discussed further in this assessment.

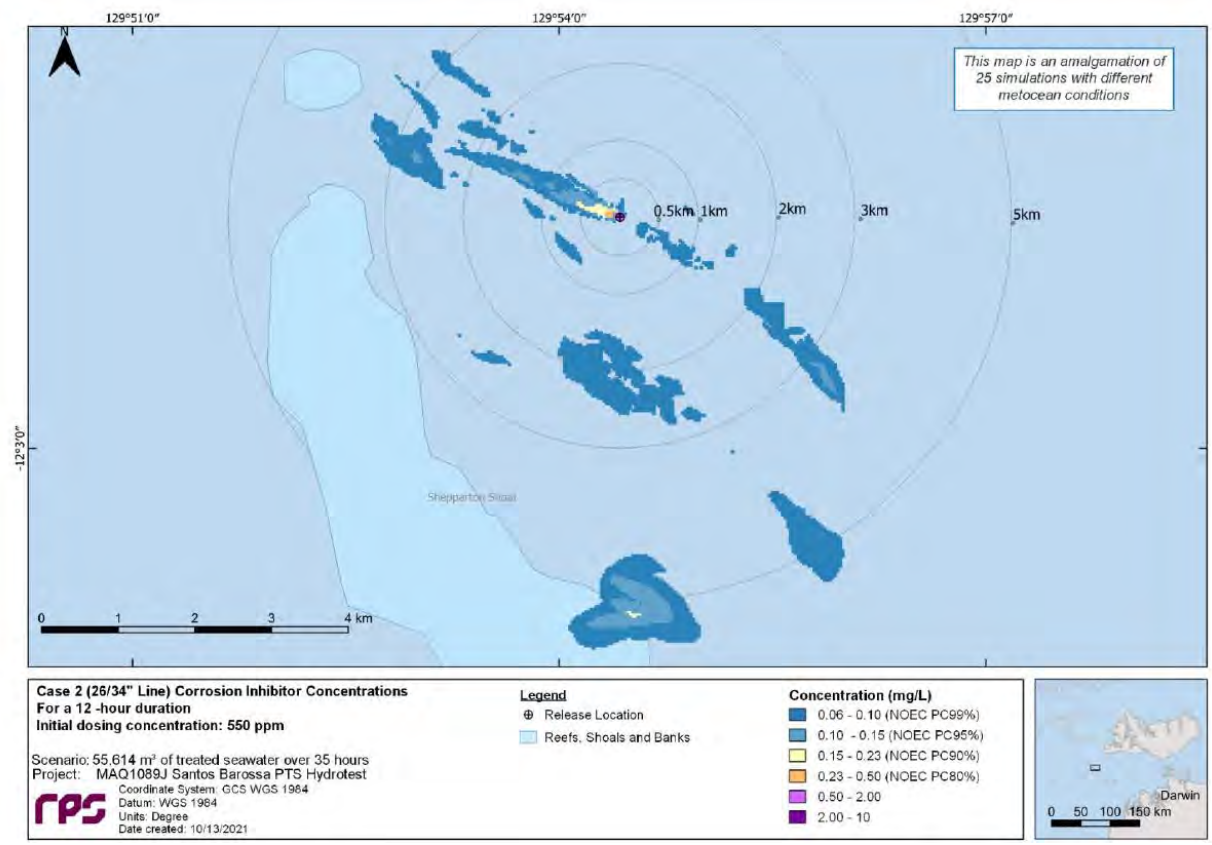


Figure 6-2: Predicted maximum Hydrosure concentrations over a 12-hour continuous exposure period calculated from 25 simulations with different metocean conditions

6.7.2.5 Water quality

RPS (2021) modelling predicted a maximum distance from the release location to the PC99% NOEC threshold of 0.06 ppm and PC95% NOEC threshold of 0.10 ppm of 7.23 km and 5.33 km, respectively. The maximum distance based on the PC80% NOEC threshold of 0.23 ppm did not exceed 0.2 km. The conservative area of exposure was predicted to be within 4.68 km^2 based on the PC99% NOEC threshold of 0.06 ppm and a 12-hour continuous exposure period.

It is important to note that the modelled results presented are considered conservative, as the Hydrosure discharge concentration was set at the maximum dosage rate of 550 ppm instead of the expected dosage rate of 350 ppm. In practice, the concentration of Hydrosure in the discharge will naturally degrade over time during the hydrotest and reduce in concentration within the pipeline. As a result, it is anticipated that the expected initial discharge concentrations of Hydrosure will be less than those modelled. Furthermore, mixing and dilution of the effluent in the receiving waters will occur, which is likely to result in mixing zone boundaries being reached closer to the discharge point compared to that predicted by the modelling outputs.

The release of treated sea water will result in a localised (around the discharge location) and temporary (within hours to days) minor reduction in water quality. Chemicals that will be used are inherently biodegradable with low

potential for bioaccumulation. For the above reasons, no substantial change in water quality is expected from activity discharges and therefore the impact is assessed as acceptable.

6.7.2.6 Plankton

Plankton drifting past the outlet at the time of discharge may be exposed to concentrations above those that could elicit an effect. However, dilution of the plumes is rapid and the exposure concentration travelling with the organism will continually reduce. Plankton are widely distributed in the ocean and regenerate rapidly and, in the context of their lifecycle, impacts will be short term and negligible.

6.7.2.7 Sediment quality

Sediments are unlikely to be impacted as activity discharges (excluding grout) will be discharged through a diffuser at nominally 3 m above the seabed.

If used, grout discharges will disperse as a fine sediment on the seabed within a few metres of the post-filled grout bags.

6.7.2.8 Other communities – benthic communities

No protected benthic habitats were identified that have the potential to be exposed to the treated sea water plumes. The seabed near the discharge location consists of predominantly bare sediment with sparse filter feeders with small outcrops of hard coral with a low abundance and diversity of infauna and are unlikely to be impacted as activity discharges will be discharged through a diffuser at nominally 3 m above the seabed. Marine invertebrates may inhabit soft sediments and can contribute to the diet of some fauna. The area of soft sediment habitat that is potentially impacted is small compared with the amount of similar habitat available across the bioregion. Therefore, the disturbance is not expected to affect prey availability, and protected fauna species, significantly.

Shepparton Shoal is approximately 3 km from the discharge location, with water depths of approximately 30 m to 50 m. Modelling predicts that the maximum dilution of up to 10,000 (>0.06 ppm) is achieved at Shepparton Shoal (refer to Table 6-24), except for the southern boundary. Modelling predicted a 4% probability of NOEC PC90% of 0.1 ppm exposure to the southern boundary of the waters above Shepparton Shoal over a 12-hour continuous exposure period (see Figure 6-2).

Shepparton Shoal is expected to support medium–density filter-feeders over most (86%) of the shoal based on surveys (Radford et al., 2019). No hard or soft corals, or *Halimeda* communities were recorded, and areas not supporting non-photic filter feeders were expected to comprise bare substrates (Radford et al., 2019). Filter feeders are particularly susceptible as they directly ingest contaminants while feeding (Keesing and Edgar, 2016). However, given the temporary (within hours to days) minor reduction in water quality and that the chemicals are inherently biodegradable with low potential for bioaccumulation, no substantial change in the benthic communities is anticipated from activity discharges and therefore the impact is assessed as acceptable given this is a one-off activity.

Furthermore, the modelled results presented are considered conservative, as the Hydrosure discharge concentration was set at the maximum dosage rate of 550 ppm instead of the expected dosage rate of 350 ppm. In practice, the concentration of Hydrosure in the discharge will naturally degrade over time during the hydrotest and reduce in concentration within the pipeline. As a result, it is anticipated that the expected initial discharge concentrations of Hydrosure will be less than those modelled. In addition, mixing and dilution of the effluent in the receiving waters will occur, which is likely to result in NOEC PC90% (and other mixing zone boundaries) being reached closer to the discharge point compared to that predicted by the modelling outputs.

6.7.2.9 Marine mammals, marine reptiles, sharks and rays, other pelagic and demersal fish

Marine fauna within the OA, some of which have cultural significance as totems or cultural food sources, are likely to be transient. If present, marine fauna could pass through the plumes. Exposure will be at low concentrations and for a short duration. The biocide chemical in the discharged treated sea water shows toxicity to marine life, with the effects greater on simpler life forms. This is illustrated in the ecotoxicological data in which the NOEC for a fish species is 12.5 ppm (time-weighted average) compared to 1.3 ppm for algae (Table 6-19). Modelling demonstrated that concentrations within the plume vary both temporally and spatially, rarely exceeding instantaneous concentrations of 10 ppm, noting that the planned concentrations and volume to be discharged are less than that modelled (see Section 6.7.2.9).

The flatback internesting BIA and habitat critical to the survival of flatback turtles intersect the proposed discharge location. However, as internesting flatbacks rarely frequent water depths greater than 30 m (water depth at the discharge location is approximately 54 m), turtles are likely to be limited to transiting individuals near the discharge location. Shepparton Shoal is at a water depth of approximately 30 m and is located approximately 3 km from the discharge location. If a turtle or other mobile transiting marine species is in the vicinity, it is predicted that exposure concentrations would unlikely illicit an effect. Mobile marine species are expected to either avoid turbid stretches of

water or pass through with no significant impacts. No aggregation areas for marine mammals, sawfish, sharks, rays or other fish were identified near the discharge location.

With controls in place, impacts to threatened and migratory species are predicted to be minor and therefore impacts and risks are deemed acceptable.

6.7.2.10 Cultural features

No First Nations people feedback was provided about potential impacts from activity discharges to cultural features during consultations for this Activity.

During consultation with Tiwi Clans, concerns were raised about potential impacts from the D&C Activity on totemic species and marine species that provide a food source for traditional fishing and hunting. Other Tiwi people also provided information to Santos that impacts to totemic species could also affect Tiwi people by making them sick. Section 6.7.2.9 describes the potential impacts to marine species of cultural significance.

6.7.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- No impacts to the marine environment from pipeline discharges resulting in a consequence severity greater than Minor [EPO-07]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 6-24 to demonstrate the potential impacts from this aspect are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 6-24: Control measures evaluation for activity discharges (excluding vessel operations)

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.7.1	Apply a chemical selection procedure for all chemicals planned to be discharged (administrative control)	Under the procedure, CHARM-rated gold/silver and non-CHARM Group E/D chemicals managed under the OCNS, or OSPAR PLONOR list, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected (Section 2.11). Therefore, the pre-commissioning fluids will pose little or no risk to the environment. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Cost of implementing procedures. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted**
C6.7.2	Contractor FCGT procedure (administrative control)	This would limit the concentration of the hydrotest mixture within the treated sea water from the FCGT activities.	Cost of implementing procedures.	**Adopted**
C6.7.3	Vertical diffuser for all subsea discharges of treated sea water (administrative control)	This control is effective in enhancing initial dilution.	Cost of implementing procedures and equipment.	**Adopted**
Additional control measures				
N/A	Omission of FCGT activities (elimination control)	This would eliminate any potential impacts from the FCGT activities.	FCGT activities are required to control the potential for corrosion of the DPD and to determine if any unacceptable restrictions and/or	**Rejected** – omission of FCGT operations was assessed but is not considered acceptable from a

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			obstructions exist in the line. In addition, potential loss of subsea infrastructure integrity could possibly lead to a larger environmental incident after commissioning.	technical and risk perspective.
N/A	Use raw sea water without any chemical treatment for FCGT activities (elimination control)	This would eliminate any potential impacts from the FCGT activities but increases the likelihood of loss of integrity during operation and has potentially greater environmental impacts.	Pre-commissioning fluids are required to verify the structural integrity of the subsea infrastructure. The FCGT volumes selected are the minimum amounts required to achieve verification. In addition, potential loss of subsea infrastructure integrity could possibly lead to an environmental incident after commissioning.	**Rejected** – not feasible as required to prevent internal corrosion and ensure pipeline integrity. Corrosion by oxidation and microbial action will occur without using sea water treatment resulting in wall thickness loss.
N/A	Sea water treated with oxygen scavenger and exposed to ultraviolet (UV) light for FCGT activities (substitution control)	Would reduce chemical discharges to sea, reducing potential impacts to marine environment.	Pre-commissioning fluids are required to verify the structural integrity of the subsea infrastructure. The FCGT volumes selected are the minimum amounts required to achieve verification over the preservation period. In addition, potential loss of subsea infrastructure integrity could possibly lead to a larger environmental incident after commissioning. The effectiveness of UV sterilisation to kill bacteria species is affected by particulate shadowing, therefore it cannot provide an absolute sterilisation solution. Furthermore, UV sterilisation provides no 'residual' treatment and as a result corrosion-causing bacteria colonies can grow during the preservation period and in the dewatered state before hydrocarbons are introduced.	**Rejected** – option of sea water treated with oxygen scavenger and exposed to UV light for bacterial sterilisation is not considered acceptable to prevent internal corrosion and ensure pipeline integrity.

6.7.4 Environmental impact assessment

Receptor	Consequence level
Activity discharges	
Threatened, migratory or local fauna	The seabed near the discharge location consists of predominantly bare sediment with sparse filter feeders with small outcrops of hard coral with a low abundance and diversity of infauna. It is predicted that there is likely to be no to negligible impact to the seabed or closest shoal (Shepparton Shoal) from activity discharges. Mobile transiting marine species are expected to pass through the small discharge plumes with no significant impacts. The toxicity of the discharged chemicals is considered low and the potential for bioaccumulation of any toxic compounds is minor given the low volumes discharged. As with all chemicals selected for use

Receptor	Consequence level
	in offshore activities by Santos, the chemicals chosen will be low aquatic toxicity (e.g. EC50/LC50 >100 ppm), low bioaccumulation potential (e.g. Log Pow <3) and readily biodegradable (e.g. more than 60% in 28 days, OECD 306), thus reducing the likelihood of any significant impacts. Marine fauna species within the vicinity of the discharge location are likely to be transient. If discharge contact does occur with any marine fauna, it will be for a short duration due to the rapid dispersion of the small plumes and the transient fauna movement—exposure time may not be long enough to cause a toxic effect. Impacts will be temporary, and the area potentially impacted is small compared with the size of the areas used by the species. Therefore, no long-term impacts to the species are expected. No decrease in local population size, area of occupancy of species, loss or disruption of critical habitat or disruption to the breeding cycle of any of the protected matters species is expected. Fish (including some sharks and rays) may forage in the soft sediments for marine invertebrates. If discharge contact does occur with fish, it will be for a short duration due to the rapid dispersion of the small plumes and the transient fauna movement—exposure time may not be long enough to cause a toxic effect. Given the low toxicity of the Activity discharges, there are no significant impacts expected to threatened and migratory fauna, and the consequence level for threatened, migratory or local fauna is considered to be II – Minor.
Physical environment or habitat	The seabed near the discharge location consists of predominantly bare sediment with sparse filter feeders with small outcrops of hard coral with a low abundance and diversity of infauna. Modelling predicted that the southern boundary of Shepparton Shoal may be exposed to treated sea water concentrations of 0.1 ppm at a low probability (4%). Shepparton Shoal is expected to be predominantly medium–density filter-feeders over most (86%) of the shoal based on surveys (Radford et al., 2019). No hard or soft corals, or *Halimeda* communities were recorded and areas not supporting non-photic filter feeders were expected to comprise bare substrates (Radford et al., 2019). Filter feeders are particularly susceptible as they directly ingest contaminants while feeding (Keesing and Edgar, 2016). Given the temporary (within hours to days) minor reduction in water quality, water depth and that the chemicals are inherently biodegradable with low potential for bioaccumulation, it is reasonable to conclude that no substantial change in the benthic communities and water quality is anticipated from activity discharges and therefore the impact is assessed as acceptable given this is a one-off activity. The consequence level for physical environment or habitat is considered to be II – Minor.
Threatened ecological communities	Not applicable – no threatened ecological communities were identified in the area over which discharges are expected.
Protected	Not applicable – no protected areas were identified in the area over which discharges are expected.
Socioeconomic receptors	There is limited activity by commercial fishers, recreation and tourism that overlap the OA. Activity discharges will be discharged via a diffuser for a short period (nominally 7 days) to enhance rapid dispersion. Contact to discharges will also be limited to transient fauna individuals where exposure time will unlikely cause a toxic effect. Given the negligible consequence to species, subsequent impacts to socioeconomic receptors are not anticipated. The consequence level for the socioeconomic receptors is considered to be II – Minor.
Cultural features	For potential impacts to marine species of cultural significance or that provide a traditional food source, and concerns that any harm to totemic species may bring sickness to Tiwi people, refer to the assessment for threatened, migratory or local fauna.
Cumulative impacts	
The offshore location of the OA means that it is unlikely that there will be a cumulative discharge impact with other marine users. Hence, no cumulative impacts are predicted.	
Overall worst-case consequence	II – Minor

6.7.5 Demonstration of as low as reasonably practicable

Using pre-commissioning fluids and resultant activity discharges is an unavoidable and planned part of the Activity. It is accepted industry practice to discharge these fluids to sea.

The small volumes of discharges will occur in a deep-water location with rapid dispersion. Applying a chemical selection process (see Section 2.11) is an important control measure for reducing the toxicity of discharges to the marine environment. Under the procedure, CHARM-rated gold/silver and non-CHARM Group E/D chemicals managed under the OCNS, or OSPAR PLONOR list, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected (Section 2.11). The pre-commissioning fluids will pose little or no risk to the environment. The consequence was assessed as II – Minor and cannot be reduced further. Additional

control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit, as detailed in Section 6.7.3. Therefore, the impact of activity discharges are considered ALARP.

6.7.6 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence from activity discharges is II – Minor.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the OA identifies pollution as a threat (Table 3-14): **Conservation Advice:** • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) **Recovery Plans:** • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b). Recovery plans / conservation advice for other species that may occur in the OA do not identify pollution as a key threat or have explicit relevant objectives or management actions. The implementation of EPO-7 and the control measures outlined in Table 6-24 will ensure that no contact with banks and shoals are predicted. The objectives of these publications were considered during impact and risk assessments. The activity is not inconsistent with these objectives. The controls outlined in Table 6-24 and the impacts of activity discharges are not inconsistent with the objectives of the material listed above.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback indicated no recommendations for revising the EPO, CMs or EPSs. However, feedback received during the development of other Barossa Gas Project EPs has been considered and where applicable and EPO-14 was adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The consequence of activity discharges on receptors is assessed as II – Minor. Based on an assessment of Santos' acceptability criteria and with the control measures in place, potential impacts are considered acceptable.

7. Unplanned events risk and impact assessment

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Evaluation of environmental impacts and risks (5) The environment plan must include: a. details of the environmental impacts and risks for the activity; and b. an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk; and c. details of the control measures that will be used to reduce the impacts and risks of the activity to ALARP and an acceptable level. (6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: a. all operations of the activity; and b. potential emergency conditions, whether resulting from accident or any other reason. *Environmental performance outcomes and standards* (7) The environment plan must: a. set environmental performance standards for the control measures identified under paragraph (5)(c); and b. set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured; and c. include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

An ENVID workshop (as described in Section 5) for unplanned events was held in October 2021. Santos' environmental assessment identified 9 environmental risks associated with unplanned events for this activity. A second ENVID workshop was held in May 2023 to revalidate the risk assessment based on changes to the Activity description. A third ENVID workshop was held in February 2024 to revalidate the risk assessment based on new information relating to receptors (including values and sensitivities obtained during consultation) (as described in Section 5.2.3), and changes to the Activity description and new requirements (such as changes to legislation, other requirements and guidelines) were also considered.

The results of the environmental and socioeconomic risk assessments are summarised in Table 7-1. A comprehensive risk and impact assessment for each unplanned event and subsequent control measures proposed by Santos to reduce the risk and impacts to ALARP are detailed in the following subsections.

Table 7-1: Environmental risk assessment summary

EP section	Unplanned event	Likelihood	Consequence	Residual risk level
7.1	Release of solid objects	D – Occasional	II – Minor	Low
7.2	Introduction of invasive marine species	B – Unlikely	IV – Major	Low
7.3	Marine fauna interaction	C – Possible	II – Minor	Low
7.4	Unplanned release: treated sea water	C – Possible	II – Minor	Low
7.5	Unplanned release: minor hydrocarbons/ chemicals	D – Occasional	I – Negligible	Low
7.6	Unplanned release: MDO	B – Unlikely	III – Moderate	Low
7.7	Contingency spill response operations	B – Unlikely	II – Minor	Very Low
7.8	Unplanned release: dry natural gas	B – Unlikely	II – Minor	Very Low
7.9	Unplanned release: nitrogen gas	B – Unlikely	II – Minor	Very Low

7.1 Release of solid objects

7.1.1 Description of event

Event	Solid objects and particles (solids) can be accidentally released to the marine environment from vessels or during installation activities. These solids may include: • suspended loads • non-hazardous wastes, such as paper, plastics, microplastics and packaging • hazardous wastes, such as batteries, fluorescent tubes, medical wastes and aerosol cans • equipment and materials, such as supplies, hard hats, tools, infrastructure parts or installation aids. Release of these solids may occur as a result of: • operator error or mechanical failure • overfull and/or uncovered bins • incorrectly disposed items • incidents during transfers of waste or supplies • accidentally dropped objects/lost equipment • particles detaching or dislodging from infrastructure.
Extent	The event will only occur within the OA, and all non-buoyant waste material or dropped objects are expected to sink to the seabed and remain within the OA. Buoyant objects could potentially move beyond the OA.
Duration	An unplanned release of solids may occur during the Activity (prior to the preservation period) being approximately 3 months and impacts may occur until the solid degrades.

7.1.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality, benthic habitats); threatened, migratory fauna or local fauna (marine reptiles, whales, fish [including sharks and rays]); socioeconomic receptors; and cultural features.

7.1.2.1 Physical environment

Release of hazardous solids (e.g. wastes such as batteries) may pollute the immediate receiving environment, leading to detrimental health impacts to marine fauna. Physiological damage can occur through ingestion; or absorption in individual fish, marine mammals, marine reptiles or seabirds.

The area of potential seabed disturbance due to release of a heavier solids would be restricted to the OA (e.g. accidentally dropped equipment). Damage to substrates within the OA and associated infauna and epifauna may occur, but such impact is expected to be restricted to the size of the dropped object. The release of microplastics has the potential to contribute to the overall amount of marine microplastics in the ocean, which can have various impacts on marine fauna as they are absorbed by plants and animals and accumulate in the food chain. However, given the very small amounts that could potentially be released, the consequence of any impacts is considered to be negligible.

The seabed within the OA is devoid of significant bathymetric features, and sediments are predominantly unconsolidated as silty, shelly sand (Figure 3-6) with very sparse (<1%) epibiota (mainly soft corals and crinoids) (RPS, 2023). The habitat type in the OA is widely distributed, well represented in northern Australia and not regionally significant. Soft sediment benthic habits will not be destroyed, but the communities on and within them (such as epifauna and infauna) will be disturbed by a dropped object; and depressions may remain on the seabed for some time after removal of the dropped object (depressions will gradually infill over time). The sea floor of this bioregion is strongly affected by long-period swells and large internal tides, which can resuspend sediments within the water column and move sediment across the sea floor.

7.1.2.2 Marine fauna – marine mammals, marine reptiles, seabirds, fish and sharks

Solids such as plastics have the potential to affect benthic environments and to harm marine fauna through entanglement or ingestion. Potential impacts to marine fauna that have cultural significance as totems or as cultural food sources, could result in reduced First Nations access to food through traditional hunting and fishing, and in accordance with First Nations cultural beliefs, if totemic species (e.g. turtles) are impacted by the Activity, some believe this in turn can impact First Nations people and make them sick. Floating, non-biodegradable marine debris has been highlighted as a threat to marine turtles, sharks, seabirds, whales and whale sharks in the relevant recovery plans and approved conservation advice (see Table 3-14). Marine turtles and seabirds are particularly at risk from entanglement and ingestion.

The recognition of the problem of plastic and microplastic debris in the marine environment is a key aspect of the National Plastics Plan (DAWE, 2021). The National Plastics Plan also includes supporting global action to address marine plastic debris, including the implementation of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018). The Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018) and Wildlife Conservation Plan for Seabirds (CoA, 2020) have specified various recovery actions to help combat this threat. Floating non-biodegradable marine debris has been highlighted as a threat to marine turtles within the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b). Marine turtles may mistake plastics for food—once ingested, plastics can damage internal tissues and inhibit physiological processes, both of which can potentially result in fauna mortality. The Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) identified marine debris as a threat to cetaceans. The pygmy blue whale may be present within the OA, but they will most likely be transient and/or migratory through the area. Plastics such as microplastics, plastic bags or bottles can cause problems by ingestion or as entanglement in small cetaceans. Entanglement and ingestion of plastics may result in the loss of reproductive fitness or mortality for cetaceans (CoA, 2015a).

Of relevance to the Activity is legislation for preventing garbage disposal from vessels, which Santos implements in accordance with MARPOL Annex V through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and Marine Order 95.

7.1.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- No loss of equipment/cargo overboard from vessels resulting in a consequence severity greater than Minor [EPO-08]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-2 to demonstrate the potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. The rejected control measure has an ALARP evaluation provided to justify its rejection.

Table 7-2: Control measures evaluation for release of solid objects

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.6.3	Routine discharges of putrescible waste, in accordance with standard maritime practice and Marine Order 95 (Marine Pollution Prevention – Garbage)	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna, and ensures compliance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage).	Cost of implementing procedures.	**Adopted**
C7.1.1	Implement standards and procedures for lifting equipment (administrative control)	Impacts to the environment are reduced by preventing dropped objects and dragged objects during lifting operations. Administrative costs to update induction materials and train personnel.	Cost of implementing procedures.	**Adopted**
C7.1.2	Dropped objects recovered where safe and practicable to do so (administrative control)	Impacts to the environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences of the dropped object are negligible or there are risks to safety.	Cost of implementing procedures.	**Adopted**
C7.1.3	Chemicals and hydrocarbons will be managed in	Reduces the risk of chemical containers being accidentally dropped to sea by controlling	Cost of implementing procedures.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	accordance with standard maritime practices (administrative control)	the storage and handling of chemicals.		
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Eliminate lifting in field (elimination control)	Reduces the risk of dropped objects.	Lifting activities are required to access the GEP PLET (e.g. removing the PLET protection structure) and to install infrastructure covered under this EP (e.g. PLET foundation and spool). Consequently, lifting is an integral activity and cannot be completely eliminated.	**Rejected** – not feasible to eliminate lifting in the field.

7.1.4 Environmental impact assessment

Receptors	• Physical environment (benthic habitats) • Threatened, migratory or local fauna (marine mammals, marine reptiles, fish [including sharks and rays]) • Socioeconomic and cultural features
Consequence	II – Minor

Physical environment (benthic habitats)

An object dropped into the sea can result in localised and short-term damage to the seabed. The extent of the impact to the seabed is limited to the size of the dropped object (e.g. tools, containers and installation equipment); given the size of the equipment used on the activity vessels.

The unplanned release of microplastics has the potential to contribute to the overall amount of marine microplastics in the ocean, which can have various impacts on marine fauna as they are absorbed by plants and animals and accumulate in the food chain. However, given the negligible amounts that may be accidentally released, the overall impact marine microplastic pollution is relatively limited.

Marine invertebrates that may inhabit disturbed soft sediment benthic habitats are expected to occur elsewhere within the OA and surrounds and therefore the disturbance is not expected to affect prey availability, or protected fauna species.

No significant seabed features or biota have been found in the OA. Therefore, it is highly unlikely that any objects dropped during the Activity would cause a significant impact to the ecological values associated with the seabed or benthic habitats. Therefore, the consequence level is considered II – Minor.

Marine fauna – marine mammals, marine reptiles, seabirds, fish and sharks

Marine debris (including plastics and microplastics) is identified as a potential threat to several marine fauna species in relevant recovery plans and conservation advice (Table 3-14). The types of solids and plastics accidentally dropped into the sea are limited by the type of activities planned. If the solid object can be ingested by marine fauna, impacts would be restricted to a small number of individuals, if any.

Microplastics within the ocean come from many sources, and the bioaccumulation potential is high within marine fauna if ingested. Filter feeders ingest substantial amounts of microplastics by directly swallowing ocean water or indirectly by consuming prey (that have microplastics within the body cavity). Given that the very small volume of unplanned microplastics and plastics that could potentially be released to the marine environment is relatively small and the distance of the OA to shorelines and sensitive turtle habitats, it is considered that the consequence of any impacts is considered to be slight. The controls implemented demonstrate that the Activity will be conducted to reduce the release of marine debris and plastic particles; therefore, potential impacts are reduced to ALARP and an acceptable level.

The limited quantities of accidental hazardous/non-hazardous solid releases indicate that, in a worst-case release, fatalities would be limited to individuals and such a release is not expected to decrease the local population size. Therefore, the consequence level is considered II – Minor.	
Socioeconomic and cultural features Given the negligible consequence on species, subsequent risks or significant impacts to socioeconomic receptors (including commercial fish stocks) and cultural features (relating to species with cultural significance) are not anticipated.	
Likelihood	D – Occasional
The proposed control measures will reduce the risk of dropped solids (including plastics), lost equipment or release of hazardous/non-hazardous solid waste to the environment. These control measures will also ensure that legislation for preventing garbage disposal from vessels is adhered to, as recommended by the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018) and supported by the National Plastics Plan (DAWE, 2021). The likelihood of the release of solid occurring over the duration of the Activity is considered 'Occasional' as it has occurred before during other Santos projects. The risk to socioeconomic receptors and cultural features is considered to be low.	
Residual Risk	The residual risk is considered Low.

7.1.5 Demonstration of as low as reasonably practicable

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.1.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk ranking is Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – controls implemented will minimise the potential impacts from the Activity to species identified in recovery plans and approved conservation advices as having the potential to be impacted by solid objects. The following material published in relation to threatened and migratory species within the OA identifies marine debris as a threat Table 3-14: **Management Plans:** • National Plastics Plan (DAWE, 2021) **Conservation Advice:** • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC, 2014a) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014). • Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g) • Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b) **Recovery Plans:** • Threat Abatement Plan for impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Seabirds (CoA, 2020). Recovery plans / conservation advice for other species that may occur in the OA do not identify marine debris as a key threat or have explicit relevant objectives or management actions related to marine debris. The OA does not intersect any AMP or protected area. The objectives of these publications were considered during impact and risk assessments. The controls outlined in Table 7-2 are consistent with the

	objectives of the material listed above. Santos considers the Activity is not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with MARPOL Annex V (through the *Protection of the Sea (Prevention of Pollution from Ship) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and Marine Order 95: Marine pollution prevention – garbage), Annex X (IMO Marine Litter Action Plan) and International Maritime Dangerous Goods Code). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback was considered and it was determined that the EPO, CMs or EPSs were appropriate to reduce the risk to ALARP. In addition, feedback received during the development of other Barossa Gas Project EPs has been considered where applicable and EPO-14 was adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

Accidental solid object releases from vessels are expected to have negligible impacts. The control measures proposed are consistent with applicable actions described in the relevant fauna recovery plans and conservation advice, and management plans. Relevant Persons concerns have been considered and existing control measures were considered ALARP. With the control measures in place to prevent accidental solid object releases, impacts are considered ALARP and environmentally acceptable.

7.2 Introduction of invasive marine species

7.2.1 Description of event

Event	Introduction of invasive marine species (IMS) may occur due to: • biofouling on activity vessels • biofouling on equipment that is routinely submerged in water • discharge of high-risk ballast water. Once established, IMS have the potential to outcompete indigenous species and affect overall native ecosystem function.
Extent	Localised (seabed and water column within the OA) to widespread if successfully translocated to new areas via ocean currents or equipment transit.
Duration	Temporary to long-term (if successfully translocated).

7.2.2 Nature and scale of environmental impacts

Potential receptors: physical environment (benthic habitat); threatened, migratory, or local fauna (marine mammals, marine turtles, sharks and rays and other fish); socioeconomic (commercial fisheries, other marine users, tourism); and cultural features.

IMS are non-native marine plants or animals that harm Australia's marine environment, social amenity or industries that use the marine environment, or have the potential to do so if they were to be introduced, established or spread in Australia's marine environment (DAWE, 2018). Most climatically compatible IMS to northern Australia are found in Southeast Asian countries.

Some IMS pose a major threat to economy and social amenity by disrupting ecological processes (DAWE, 2018; Wells et al., 2009). When IMS achieve pest status, they are commonly referred to as introduced marine pests (IMPs). IMPs can cause various adverse effects in a receiving environment, including:

- over-predation of native flora and fauna
- outcompeting native flora and fauna for food
- human illness through released toxins
- depleting viable fishing areas and aquaculture stock
- reducing coastal aesthetics
- damage to marine and industrial equipment and subsea infrastructure.

The above impacts can result in flow-on detrimental effects to marine parks, tourism, recreation and cultural features, noting that some native fauna may have cultural significance as dreaming totems or as a traditional food source.

Species of concern are those that are not native to the region, are likely to survive and establish in the region, and that can spread by human-mediated or natural means. Species of concern vary from one region to another depending on various environmental factors, such as water temperature, salinity, nutrient levels and habitat type. These factors dictate their survival and invasive capabilities.

Artificial, disturbed and polluted habitats in tropical regions are susceptible to introductions, which is why ports are often areas of higher IMS risk (Neil et al., 2005). However, in Australia there are limited records of detrimental impact from IMS compared with other tropical regions (such as the Caribbean).

Once IMS populations have established, they are difficult to eradicate, limiting management options to ongoing control or impact minimisation. However, this depends on the environmental conditions and species. For this reason, increased management requirements have been implemented in recent years by various Australian regulatory agencies.

If an IMS is introduced, species have been known to colonise areas outside the areas where they were introduced but this depends on the diversity and extent of suitable habitat for colonisation.

Potential sources for introducing IMS into the OA include biofouling on vessels, including external niches (e.g. propulsion units, steering gear and thruster tunnels) and internal niches (e.g. sea chests, strainers, sea water pipework, anchor cable lockers and bilge spaces). Ballast water is responsible for up to 30% of all marine pest incursions into Australia, while biofouling (the accumulation of aquatic microorganisms, algae, plants and animals on vessel hulls and submerged surfaces) is also considered a significant pathway for the potential introduction and spread of marine pests (DAWE, 2018).

Equipment that is submerged in water for periods of time (such as ROVs) may acquire marine pest species, which can be spread if the equipment is not cleaned before being used in pest-free areas.

IMS are generally unable to successfully establish in deep water ecosystems (Geiling, 2014), most likely due to a lack of light and suitable habitat to sustain their growth and survival. Therefore, most IMS are found in tidal and subtidal zones with only a few species known to extend into deeper waters of the continental shelf (Bax et al., 2003). Most species introduced to an area outside their natural range (e.g. via ballast water) will not survive to establish or subsequently become invasive or a pest (Wells et al., 2009).

IMS risks are relevant to all maritime activities, including commercial shipping, fishing, military, petroleum and recreational boating.

7.2.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- Prevent the displacement of native marine species as a result of the introduction and establishment of IMS via activity vessels [EPO-09].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-3 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-3: Control measures evaluation for introduction of IMS

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C7.2.1	Vessels equipped with effective anti-fouling coatings (administrative control)	The likelihood of introducing IMS is reduced due to anti-fouling systems compliant with Marine Order 98.	Could lead to potential delays and therefore costs in vessel contracting process due to availability of vessels with appropriate anti-foulant systems.	**Adopted**
C7.2.2	Vessels undertake ballast water management or treatment to achieve low-risk ballast water (administrative control)	The likelihood of introducing IMS via ballasting activities is reduced by implementing the Australian Ballast Water Management requirements (DAWE, 2020a).	Cost associated with reducing the vessel risk to 'low' and implementing procedures.	**Adopted**
C7.2.3	Apply risk-based IMS management for vessels (administrative control)	The likelihood of introducing IMS is reduced by implementing proactive biofouling management options recommended under the Australian Biofouling Management Requirements (DAFF, 2023) and Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2009).	Cost associated with implementing procedures and mitigation measures (e.g. dry docking, hull cleaning or additional costs due to inspections). Costs associated with reducing the vessel risk to 'low'.	**Adopted**
C7.2.4	Marine Growth Prevention System (administrative control)	The likelihood of introducing IMS is reduced by preventing vessel marine growth (such as barnacles and mussels).	Cost associated with implementing procedures and implementing the mitigation measures.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements. Ensures personnel are suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.1.3	The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes (administrative control)	Santos marine vetting process ensures the risk of introducing invasive marine species during activities undertaken by Santos in Australian waters is minimised through by carrying out a Biosecurity Risk Assessment prior to engagement.	Regulatory requirement and therefore the cost is not identified as an issue.	**Adopted**
N/A	Heat treatment of ballast water to eliminate IMS (administrative control)	Would reduce potential for IMS to establish by reducing the potential for IMS present in ballast water.	Compared to traditional ballast treatment (e.g. chemical additive) methods, heat treatment has a higher cost and increased energy consumption. Ballast requirements are adequately managed under Australian Ballast Water Management (DAWE, 2020a) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments to reduce the risk of IMS introduction.	**Rejected** – based on high cost considered disproportionate compared with risk (after application of standard control measures [see above]).
N/A	Contract vessels only operating in local, state/territory or Commonwealth waters to reduce potential for IMS (substitute control)	Reduce potential for IMS to be transported into area since vessels would not have originated elsewhere.	Vessels and equipment suitable for the Activity are not available in 'local' waters.	**Rejected** – suitable vessels are not 'locally' available. All contracted vessels must be 'low' risk of introducing IMS regardless of their origin.
N/A	Mandatory dry docking of vessels before entering field to clean vessel and/or equipment and remove biofouling (administrative control)	Ensures that the risk of IMS being present on vessel or associated equipment is low.	Significant cost (grossly disproportionate to the risk) and would lead to scheduling delays.	**Rejected** – costs disproportionately high compared with environmental benefit given the proposed risk-based management framework, which includes potential dry docking and cleaning if justified based on risk assessment.
N/A	Use an alternative ballast system to avoid uptake or discharge of water (substitute control)	Eliminate need for ballast water exchange, therefore decreasing risk of introducing IMS through ballast water.	Vessels suitable for the Activity do not have options for alternative ballast system, therefore would require modification at significant cost.	**Rejected** – costs disproportionately high compared with environment benefit given other controls in place already adequately reduce the risk.

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
N/A	Do not discharge ballast water (elimination control)	Would reduce the potential for introducing IMS by implementing a no ballast water exchange policy on vessels.	Ballast water exchange required on the vessels for stability.	**Rejected** – ballast water exchange is a safety-critical activity for marine operations.

7.2.4 Environmental impact assessment

Receptors	• Physical environment (benthic habitats and primary producers) • Threatened, migratory, or local fauna (marine mammals, marine turtles, fish [including sharks and rays]) • Socioeconomic (commercial fisheries, other marine users and tourism) • Cultural features
Consequence	IV – Major
Physical environment (benthic habitats and primary producers) Within the OA, the water depths range from approximately 50 m to 60 m. The OA does not present a benthic habitat or community structure that is favourable to IMS survival. The seabed within the OA is characterised as silty, shelly sand (Figure 3-6) with very sparse (<1%) epibiota (mainly soft corals and crinoids) (RPS, 2023). The closest shoal is Shepparton Shoal and Afghan Shoal, 0.1 km and 19 km away from the OA, respectively, with Shepparton Shoal approximately 1.1 km from the DPD route. Shepparton Shoal has water depths of 30 m to 50 m which limit the amount of light to the shoal. The consequence level is considered IV – Major.	
Threatened, migratory, or local fauna (marine mammals, marine turtles, fish [including sharks and rays]) IMS, if successfully established, can outcompete native species for food or space, prey on native species or change the nature of the environment. The Wildlife Conservation Plan for Migratory Shorebirds identified IMS from ballast water and hull transport as a threat to migratory shorebirds, particularly if the introduction results in the loss of benthic food sources at important intertidal habitat (CoA, 2015c). The consequence level is considered IV – Major.	
Socioeconomic (commercial fisheries, other marine users and tourism) The introduction of IMS could have a detrimental effect on commercial fisheries, other marine users, tourism and cultural features in the area due to the IMS outcompeting native species for food or space, prey on native species or change the nature of the environment; therefore, the consequence level is considered IV – Major.	
Cultural features For potential impacts to marine species of cultural significance or that provide a traditional food source, refer to the assessment for threatened, migratory or local fauna.	
Likelihood	B – Unlikely
The pathways for IMS introduction are well known; consequently, standard preventive measures are proposed. The ability for IMS to colonise a habitat depends on several environmental conditions. Highly disturbed environments (such as marinas) are more susceptible to colonisation than are open-water environments where the number of dilutions and the degree of dispersal are high (Paulay et al., 2002). IMS are more likely to populate shallower areas with favourable substrates, such as on shoals and reefs. The closest sensitive habitat that may provide suitable habitat is Shepparton Shoal (approximately 1.1 km away from the DPD route) and distant from coastal habitats. With control measures in place to reduce the risk of introduction of IMS, the likelihood of introducing an IMS is considered unlikely.	
Residual Risk	The residual risk is considered Low.

7.2.5 Demonstration of as low as reasonably practicable

There are no alternatives to the use of activity vessels in order to undertake the Activity. The risks from IMS are well understood and, with the proposed control measures, the Activity will comply with relevant regulations and guidelines. All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a 'Low' level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.2.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk ranking is Low.

Is further information required to validate the consequence assessment?	No – potential impacts and risks well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The Wildlife Conservation Plan for Seabirds (COA, 2020) and Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) identified disease, pathogens and invasive species as a threat (Table 3-14). Santos considers the impacts of IMS to be not inconsistent with this Plan. Recovery plans / conservation advice for other species that may occur in the OA do not identify invasive species or disease as a key threat or have explicit relevant objectives or management actions related to invasive species or disease. The OA does not intersect any AMP. The objectives and actions of this Plan were considered during impact and risk assessments. The controls outlined in Table 7-3 are not inconsistent with the objectives of the material listed above and Santos considers the risk of introducing IMS to be not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with the *Biosecurity Act 2015* (Cth), Australian Ballast Water Requirements: Version 8 (DAWE, 2020a), Australian biofouling management requirements (DAFF, 2023), Offshore Installations – Biosecurity Guide (DAFF, 2023a), International Convention for the Control and Management of Ships' Ballast Water and Sediments, Marine Order 98 (Marine pollution – anti-fouling systems), IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2011) and National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2009). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – no objections or claims raised by Relevant Persons during consultation of this EP or the GEP EP relating specifically to potential introduction of IMS.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The mobilisation of activity vessels and equipment to undertake offshore petroleum activities is industry standard practice, and the IMS risks are well understood and subject to regulation. The activity vessels and equipment that are internationally mobilised will meet Australian biosecurity clearance requirements, and the proposed control measures are consistent with Australian biofouling management requirements (DAFF, 2023), Australian Ballast Water Requirements: Version 8 (DAWE, 2020a) and National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2009).

Application of the proposed control measures and adherence to legislation and regulations reduce the likelihood of introducing IMS into the OA, and the dispersive offshore location in the OA reduces the probability of successful establishment in the unlikely event of introduction.

No Relevant Persons concerns have been raised regarding this aspect, and the proposed controls will reduce the residual level of risk to Low and ALARP. Therefore, the residual risk associated with IMS is considered by Santos to be environmentally acceptable.

7.3 Marine fauna interaction

7.3.1 Description of event

Event	There is the potential for activity vessels and other support to interact with marine fauna, including potential strike or collision, potentially resulting in severe injury or mortality. Activity vessel speeds are generally slow and will be limited to ≤8 knots within the OA. Furthermore, the pipelay vessel will be restricted to approximately 1 knot during pipelay activities, with the vessel moving forward in nominal 12 m steps during installation.
Extent	Within the OA.
Duration	During the Activity.

7.3.2 Nature and scale of environmental impacts

Potential receptors: threatened, migratory fauna or local fauna (marine mammals, marine turtles, whale sharks, seabirds); socioeconomic receptors (tourism, recreation) and cultural features via risks to fauna.

Marine fauna in surface waters that are most at risk from vessel collision include marine mammals, marine turtles, whale sharks and birds. Consultation has identified that some marine fauna may have cultural significance. There are no breeding, feeding, aggregation or migration BIAs. There is one internesting habitat for the flatback turtle which extends more than 800 km of NT coastline; however, the OA does not provide suitable internesting or foraging habitat for turtles, given the distance to the nesting beaches and water depths exceed 50 m.

The pipelay vessel will be travelling at approximately 1 knot; therefore, it is effectively immobile and will not pose a vessel collision risk to marine fauna. The potential risk of a collision with marine fauna is directly related to the abundance of marine fauna and number of vessels in the OA, and the actual likelihood of a collision occurring is also influenced by vessel speed.

Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans and turtles, with faster moving vessels posing a greater collision risk than slower vessels (Hazel et al., 2009; Jensen and Silber, 2004; Laist et al., 2001; CoA, 2017b). Laist et al. (2001) suggest the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster. Turtles will typically avoid vessels by rapidly diving, however, their ability to respond varies greatly depending on the speed of the vessel. Hazel (2009) reported that the number of turtles that fled vessels decreased significantly as vessel speed increases. Turtles are also adapted to detect sound in water (Popper et al., 2014) and will generally move from anthropogenic noise generating sources, including vessels, within their detection range (pers. comm. M. Guinea, Charles Darwin University, 2015). Although collisions with marine fauna can happen anywhere in Australian waters, the risk of collision is greater in breeding areas and along seasonal migration routes. Collision risk also increases in shallower waters where a vessel has less under-keel clearance, leaving an animal less room to avoid the vessel (AMSA, 2023).

The behaviour of the individual may also influence the potential for a collision with a vessel. For example, it has been suggested that individual whales engaged in feeding, mating or nursing behaviours may be more vulnerable to vessel collision as they are distracted by these activities and consequently less aware of their surroundings (Laist et al., 2001). A study on the behavioural responses of blue whales to vessels showed limited behavioural response when being approached by vessels (McKenna et al., 2015, cited in DoEE, 2016).

Vessel or anthropogenic disturbance are identified as potential threats to several marine species in relevant recovery plans and conservation advices (Table 3-14). Marine fauna interactions are recorded and reported by Santos as described in Section 8.8.

7.3.2.1 Marine mammals

The Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015c) indicates that humpback whales are one of the most frequently reported whale species involved in vessel strikes worldwide (Laist et al., 2001; Jensen and Silber, 2004). This observation is supported by Australian studies referenced in the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2017). Increased vessel numbers (Silber and Bettridge, 2012) are not only a threat to humpback whales in relation to vessel strikes but also in relation to disturbance and displacement from key habitats. Although there may be individual humpback whales within the OA, the primary migratory route for humpback whales is near the Kimberley coastline and up to Camden Sound, located more than 710 km south-west of the OA. Therefore, it is unlikely that activity vessels will interact with this species.

Similarly, vessel strike is also recognised by the Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b), Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) and Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a). The blue, sei and fin whales have a wide distribution throughout

offshore waters and, therefore, may pass through the OA in low numbers. Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans, with faster-moving vessels posing a greater collision risk than slower vessels (Laist et.al., 2001; Jensen and Silber, 2003; Hazel, 2009). Laist et al. (2001) suggest that the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster. However, considering the relatively slow vessel speeds within the OA and the mobility of whale species, it is unlikely that activity vessels will adversely interact with any individuals.

Collisions between vessels and cetaceans are most frequent on continental shelf areas where high vessel traffic and cetacean habitat occur simultaneously (Simmonds et al., 2004). There have been recorded instances of cetacean deaths as a result of vessel collisions in Australian waters (e.g. a Bryde's whale in Bass Strait in 1992) (Simmonds et al., 2004), although the data indicate this is likely to be associated with container ships and fast ferries. Some cetacean species, such as humpback whales, can detect and change course to avoid a vessel (Simmonds et al., 2004).

As presented in the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2017), most reported vessel collisions for whales in Australian waters between 1990 and 2015 have occurred along eastern or south-eastern Australia, with no reported incidents in NT waters. The International Whaling Commission has compiled a database of the worldwide occurrence of vessel strikes to cetaceans, within which Australia constitutes approximately 7% (35 reports) of the reported worldwide (approximately 471 reports) vessel strike records involving large whales (Peel et al., 2018).

Whales' reactions to approaching vessels are variable. Some species remain motionless when close to a vessel, while others are known to be curious and often approach slow-moving or stationary vessels, although they generally do not approach and sometimes avoid faster-moving vessels (Richardson et al., 1995).

Dugongs are not expected to occur in the OA, preferring shallow tidal and subtidal seagrass meadows less than 10 m deep and, therefore, are interaction is expected to be unlikely and limited to transiting individuals (Cardno, 2015).

Dolphins (Australian snubfin dolphin, Australian humpback, spotted bottlenose) may transit through the OA; therefore, collisions between activity vessels and dolphin species are possible. However, collisions with dolphins are very infrequent due to the high mobility of these smaller cetaceans, allowing them to avoid vessels. The closest dolphin BIA is the Australian humpback dolphin (breeding), greater than 45 km from the OA. It is noted that dolphins are naturally inquisitive marine mammals, some of which are often attracted to vessels underway (e.g. commonly 'bow ride' with vessels).

There are no known BIAs (including breeding or migration) for cetaceans within the OA, and therefore it is unlikely that peaks of presence will be observed, but individuals of various species may be encountered at any time of year.

7.3.2.2 Marine reptiles

The Recovery Plan for Marine Turtles in Australia 2017–2027 recognises increased vessel traffic as one of several key impacts on marine turtles (CoA, 2017b), with vessel disturbance posing a risk to flatback turtles. The plan also notes that while a vessel strike can be fatal for an individual turtle, vessels strike (as a standalone threat) has not been shown to cause declines at a population or stock level and have considered vessel disturbance to be of minor consequence to turtle populations in the NT (DoEE, 2017). Marine turtle mortality due to vessel strike was identified as an issue in Queensland waters in the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b). However, turtles appear to be more vulnerable to vessel strike in areas of high urban population where incidents with recreational vessel are higher. The approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b) listed boat strike as a threat. Turtles spend relatively limited (3 to 6%) time at the surface, with dive times generally lasting 15 to 60 minutes (Milton and Lutz, 2003; cited in Woodside Energy Limited, 2014). Marine turtles are highly mobile and, given the low speeds of activity vessels, are likely to be able to move from an area where there are vessels. Marine turtles make extensive migrations through the broader region; and it is possible individual turtles of any of the region's species may be encountered in the OA; however, the OA does not contain any significant feeding, breeding or aggregation areas for marine turtles.

There is an internesting BIA for flatback turtles within the OA, which may increase the number of individuals from June to September. Olive ridley turtles are likely to have an increase in the number of individuals from April to August. These periods increase the risk of vessel strikes. The Recovery Plan for Marine Turtles in Australia 2017–2027 defines a 60 km internesting buffer around the Tiwi Islands, which also intersects the OA. Other turtles, such as green, hawksbill, and loggerhead, may also be within the OA. Internesting olive ridley and flatback turtles are expected to be concentrated in relatively shallow coastal waters (<30 m deep) around nesting beaches. Benthic habitat within the 30 m isobath around the Tiwi Islands is broadly represented and the OA exceeds a water depth of 30 m, ranging from 50–60 m.

The pipelay vessel will lay pipe at very low speeds (<1 knot) with a negligible risk of colliding with marine fauna during this activity. Support and supply vessel for the activity will maintain speeds of ≤8 knots within the OA and as such the risk of vessel strike is strongly reduced. The risk of coming into contact with turtles is low as turtles are

expected to dive or move away from the activity vessels. Consequently, the likelihood of a vessel strike and injury/mortality to individual turtles within the OA is considered unlikely. The Recovery Plan for Marine Turtles in Australia 2017–2027 notes that while a vessel strike can be fatal for an individual turtle, vessel strikes (as a standalone threat) have not been shown to cause declines at a population or stock level and have considered vessel disturbance to be of minor consequence to turtle populations in the NT (CoA, 2017b).

Individual sea snakes and crocodiles may transit through the OA. If a vessel strike was to occur, it is unlikely to threaten the overall viability of either population.

7.3.2.3 Sharks, rays and other fish

Most sawfish, sharks, rays and other fish identified as potentially occurring within the OA are not considered at risk of vessel strike as they largely occur on or near the seabed and are not expected to come to the surface, except the giant manta ray and whale shark.

The giant manta ray is oceanic and known to feed on plankton, so it may occasionally be close to the sea surface. However, ~73% of its diet is from deep water sources (Burgess et al., 2016). The giant manta ray is not expected to come to the surface within the OA frequently and is highly mobile (therefore able to avoid vessels). Therefore, vessel collisions with giant manta rays are considered improbable.

The whale shark BIA does not overlap the OA and therefore significant numbers are not expected to be encountered. Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g) states that vessel strike from large vessels is a threat to whale sharks. Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where options to dive are limited). Whale sharks have been shown to spend approximately 25% of their time less than 2 m from the surface and more than 40% of their time in the upper 15 m of the water column (Wilson et al., 2006; Gleiss et al., 2013). The OA does not overlap known whale shark foraging areas, and whale shark presence may be transitory and of a short duration. No constraints within the OA (e.g. shallow water or shorelines) would prevent whale sharks from moving away from vessels. Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, with faster-moving vessels posing a greater collision risk than slower vessels (Laist et.al., 2001; Jensen and Silber, 2003; Hazel, 2009).

Whale sharks, other pelagic fish and demersal fish, are likely to exhibit a short-term avoidance to vessels and ROVs. This is likely be initiated through the vibrations and underwater noise emitted from these activities (Section 6.1) rather than the physical presence. Such avoidance is likely to be temporary but will further reduce the potential for collisions to occur.

7.3.2.4 Birds

The OA has no bird BIAs, but several protected species of seabirds and migratory birds may occur at times within the OA (Table 3-12). Birds may opportunistically rest on a vessel and may be attracted to activity vessels due to lighting and vessel discharges such as macerated food waste. The Wildlife Conservation Plan for Migratory Shorebirds suggest that disturbance from human activities to shorebirds may compromise energy reserved for migration (CoA, 2015c). Although seabirds may be attracted to activity vessels due to increased feeding opportunities, these behavioural changes are unlikely to alter population dynamics or significantly change the habitat use of birds due to the very short duration of the Activity. The Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) indicates that anthropogenic disturbance is a threat, but it relates to disturbance of important sites.

The risk of bird collision with helicopter operations is an ongoing concern for the safety of flights to and from pipelay and construction vessels. The consequence of a helicopter bird strike is related to seasonal distribution, body mass, flocking behaviour, and flight behaviour, while the probability of a strike is related to the abundance of different bird species on or near the vessels. Helicopter noise is expected to elicit a behavioural response in birds to avoid a collision and given the relatively low speeds of helicopters, while flying during take-off or landing, a helicopter strike is unlikely.

7.3.2.5 Cultural features

No First Nations people feedback was provided about potential marine fauna interactions during consultation for this EP. The First Nations people maintain a continuing spiritual connection with sea country, including caring for sea country and access to cultural food sources. Sections 7.3.2.1 to 7.3.2.4 describes the potential impacts to marine species of cultural significance.

Information was provided by Tiwi clients of the EDO during the D&C EP consultation about the potential impacts to marine fauna totemic species, such as marine turtles, and that if something bad happens to the totem, it can make Tiwi people sick. They also raised concerns about impacts to turtles from ships propellers, and potential for impacts to seagulls by flying helicopters over Seagull Island. Sections 7.3.2.1 to 7.3.2.4 assess the potential impacts to marine species, that are also culturally significant.

7.3.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with activity vessels [EPO-10]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-4 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-4: Control measures evaluation for marine fauna interaction

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.3.1	Avoid activities near cetaceans and turtles (isolation control)	Reduces risk of physical and behavioural impacts to marine fauna from vessels because if they are sighted, then vessels can slow down or move away (excluding vessels which are unable to alter path while performing operations), and helicopters can increase distances from sighted fauna if required. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Potential delay in vessel and helicopter movement, increasing activity duration and costs to Santos. Cost associated with implementing procedures. Regulatory requirements under EPBC Regulations 2000.	**Adopted**
Additional control measures				
C6.1.5	Vessel speed restrictions (substitute control)	Reduces consequence of collisions (causing harm) and likelihood as fauna have longer to detect and avoid the vessel by restricting vessel speeds in the OA to 8 knots or less. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine mammals.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew and helicopter operators are aware of the stringent EP, Santos and legislative requirements. Ensures personnel as suitably aware of cultural features and values.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
C6.3.2	A crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours (administrative control)	Improved ability to spot and identify marine fauna.	Operational costs to adhere to training crew members as MFOs and implementation.	**Adopted**
N/A	Avoid operating during the peak internesting period for the flatback and olive ridley turtles (elimination control)	Potential to avoid a period with higher turtle activity to reduce the likelihood of disturbance.	Potential to have schedule and cost implications.	**Rejected** – The olive ridley and flatback turtles nesting seasons on Bathurst Island do not have distinct nesting seasons and instead have low-level nesting year-round, with a peak from April–September. In addition, the OA does not provide suitable internesting or foraging habitat and therefore activities are unlikely to displace or interrupt biological behaviours. Hence, implementing seasonal control will have negligible environmental benefits.
N/A	Activities will only occur during daylight hours (elimination control)	Potential for a vessel fauna collision occurring is decreased due to vessel being stationary when visibility is lower at night.	Vessels are required to support 24-hour operations as halting operations overnight could have pipeline fatigue implications that may reduce the pipeline integrity. In addition, it would increase the Activity duration resulting in significant financial costs. No other maritime industry has such a restriction.	**Rejected** – The high financial cost and pipeline integrity implications would be grossly disproportionate to negligible environmental benefits.

7.3.4 Environmental impact assessment

Receptors	• Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and seabirds) • Socioeconomic (commercial fisheries, other marine users and tourism) • Cultural features
Consequence	II – Minor
If a vessel or helicopter collides with marine fauna, including seabirds, there is the potential for individual animal injury or death. The number of receptors present at the OA is expected to be limited to a small number of transient individuals. Injury or death to individual animals would be highly undesirable, but it would represent a small proportion of any local population, and any change in population size would likely be within the range of natural variation. The consequence level is considered II – Minor. Given the minor consequence on species, subsequent risks or significant impacts to socioeconomic receptors (including tourism and recreation) and cultural features relating to species with cultural significance are not anticipated.	
Likelihood	C – Possible
There are no breeding, feeding, aggregation or migration BIAs. There is one internesting habitat for the flatback turtle which extends more than 800 km of NT coastline; however, as the OA does not provide suitable internesting or foraging habitat for	

turtles, given the distance to the nesting beaches and water depths exceed 50 m, it is likely limited to individuals transiting the OA. In addition, marine fauna tend to move away from vessels and helicopters. The control measure, C6.1.5, restricts all activity vessels within the OA to ≤8 knots. Furthermore, the pipelay vessel will travel at very low speeds (<1 knot),while laying pipe and hence this vessel will not pose any credible risk of marine fauna injury during pipelay activities. The control measure, C6.3, requires the Santos procedure for interacting with marine fauna (EA-91-II-00003) reduces vessel speed further and introduces cautionary zones where fauna are sighted by the vessel master or crew who act as MFO. As the water depths exceed 50 m within the OA, the collision risk is reduced by providing under-keel clearance and enabling the fauna to avoid vessels. The likelihood of marine fauna interaction resulting in injury or mortality is considered possible.

Residual Risk	The residual risk is considered Low

7.3.5 Demonstration of as low as reasonably practicable

No alternative options to using vessels, ROVs and helicopters are possible for undertaking the Activity.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.3.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – maximum marine fauna interaction residual risk ranking is Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the OA identifies vessel collision or anthropogenic disturbance as a threat Table 3-14: **Conservation Advice:** • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) • Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g) • Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b) **Management Plans:** • National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2017) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) identifies vessel collisions as a threat to blue whales: 'Action A4: minimising vessel collisions by ensuring the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required appropriate mitigation measures are implemented; and ensure all vessel strike incidents are reported in the National Ship Strike database'. The adoption of EPO-10, C6.1.5 and C6.3.1 reduces potential impacts, hence is considered not inconsistent with the objectives of this management plan. • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c). For all the recovery plans identified above, the objectives are achieved by adopting EPO-10 and control measures outlines in Table 7-4, Santos considers the impacts of marine fauna interaction to be not inconsistent with these recovery plans. Recovery plans / conservation advice for other species that may occur in the OA do not identify vessel or anthropogenic disturbance as a key threat or have explicit relevant objectives or management actions related to vessel or

	anthropogenic disturbance. The OA does not intersect any AMP or protected area. The objectives and actions of these publications were considered during impact and risk assessments. The controls outlined in Table 7-4 are not inconsistent with the objectives of the material listed above and Santos considers the risk of marine fauna interactions to be not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with EPBC Regulations Part 8. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant feedback relating to potential marine fauna interaction has been considered. Existing control measures are considered adequate to reduce the risk to ALARP. Given the proximity of the GEP OA and DPD (NT), feedback received for these activities has been considered and where applicable an additional EPO, CMs and EPSs (e.g. EPO-14 and C6.3.2) were adopted.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

Activity vessels must move to undertake the Activity. The possibility of vessel strike is a well understood risk for maritime operations, including for commercial shipping and fishing. Vessel movements will comply with all relevant maritime standards and regulations, including EPBC Regulations to minimise risks to marine fauna. Application of the proposed management controls and adherence to regulations reduces the likelihood of vessel interactions with marine fauna. Although the potential exists for a collision to occur, it is considered a C – possible scenario. As part of Santos' reporting requirements for the Activity, if an impact to cetaceans did occur in the OA, it will be reported in the National Ship Strike database (see Table 8-5). With application of the proposed control measures, the potential impacts and risks to threatened fauna will be managed consistent with relevant recovery plans and approved conservation advice. Relevant Person feedback for this EP and other Barossa Project EPs relating to potential marine fauna interaction has been considered and additional EPOs, CMs and EPSs were adopted. Therefore, the impact is considered to be ALARP and environmentally acceptable.

7.4 Unplanned release: treated sea water

7.4.1 Description of event

Event	The unplanned release of treated sea water (contingency dewatering) may occur as a result of a wet-buckle or stuck pig during pipeline installation resulting in untreated sea water entering the DPD. The volume of treated sea water required to dewater will vary, with a maximum volume up to 50,120 m³. Refer to Section 6.7 for the impact assessment of the treatment chemicals.
Extent	The release is expected to disperse rapidly and be diluted within the OA.
Duration	Water quality changes are expected to recover within a very short period (hours to days) immediately following release.

7.4.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water and sediment quality, benthic habitats); threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds); socioeconomic and cultural features.

Refer to Section 6.7.2 for a comprehensive impact assessment. This impact assessment considered the maximum volume of unplanned treated sea water released, noting that the dosing concentrations and volumes are likely to be less than that assessed in the impact assessment.

7.4.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- Zero unplanned release of chemicals to the marine environment [EPO-11].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-5 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-5: Control measures evaluation for unplanned treated sea water release

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.7.1	Apply a chemical selection procedure for all chemicals planned to be discharged (administrative control)	Under the procedure, CHARM-rated gold/silver and non-CHARM Group E/D chemicals managed under the OCNS, or OSPAR PLONOR list, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected (Section 2.11). Therefore, the pre-commissioning fluids will pose little or no risk to the environment.	Cost of implementing procedures. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted**
C6.7.2	Contractor FCGT procedure (administrative control)	This would limit the concentration of the hydrotest mixture within the treated sea water from the FCGT activities.	Cost of implementing procedures.	**Adopted**
Additional control measures				
C6.2.3	DGPS for pipelay vessel to maintain accurate vessel position during	The control is effective in ensuring vessels, in combination with DP systems, are positioned with high accuracy. This	Costs are expected as part of standard procedure.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	installation (administrative control)	ensures the DPD is installed along the desired route. The proposed pipeline route has been designed to avoid sensitive benthic features and minimise the requirement for span rectification.		
C7.4.2	Pipeline installation procedure (administrative control)	This control effectively reduces the likelihood of a wet buckle occurring, hence preventing unplanned treated sea water releases.	Cost of implementing procedures.	**Adopted**
N/A	Omission of FCGT activities (elimination control)	This would eliminate any potential impacts from the FCGT activities.	FCGT activities are required to control the potential for corrosion of the DPD and to determine if any unacceptable restrictions and/or obstructions exist in the line. In addition, potential loss of subsea infrastructure integrity could possibly lead to a larger environmental incident after commissioning.	**Rejected** – not considered feasible from a technical and risk perspective.
N/A	Use raw sea water without any chemical treatment for FCGT activities (elimination control)	This would eliminate any potential impacts from the FCGT activities but increases likelihood of loss of integrity during operation and potentially greater environmental impacts.	Pre-commissioning fluids are required to verify the structural integrity of the subsea infrastructure. The volumes selected are required to achieve verification. In addition, potential loss of production due to loss of integrity possibly leading to a larger environmental incident.	**Rejected** – not feasible to prevent internal corrosion and ensure DPD integrity. Corrosion by oxidation and microbial action will occur without using sea water treatment resulting in wall thickness loss.

7.4.4 Environmental impact assessment

Receptors	• Physical environment (water quality, benthic habitat) • Threatened, migratory or local fauna (marine mammals, marine reptiles, fish [including sharks and rays]) • Socioeconomic (commercial fishing) • Cultural features
Consequence	II – Minor
Refer to Section 6.7.4 for a comprehensive impact assessment. This impact assessment considered the maximum volume of an unplanned treated sea water released, noting that the dosing concentrations and volumes are likely to be less than that assessed in the impact assessment.	
Likelihood	C – Possible
The proposed control measures will reduce the risk of an unplanned treated sea water release. The likelihood of an unplanned release of treated seawater event occurring is considered C – Possible.	

Residual Risk	The residual risk is considered Low.

7.4.5 Demonstration of as low as reasonably practicable

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.4.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked as Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the OA identifies pollution as a threat (Table 3-14): **Conservation Advice:** • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) • Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015f) • Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) • Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b) **Recovery Plans:** • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Seabirds (CoA, 2020) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c). Recovery plans / conservation advice for other species that may occur in the OA do not identify habitat degradation / modification or pollution as a key threat or have explicit relevant objectives or management actions. The objectives of these publications were considered during impact and risk assessments. The Activity is not inconsistent with these objectives. The EPO-11 and the control measures outlined in Table 7-5 are not inconsistent with the objectives of the material listed above. Santos considers the impacts unplanned treated sea water release due to a wet buckle event is not inconsistent with these objectives.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant feedback relating to a potential unplanned treated seawater release has been considered and the existing control measures are considered sufficient to reduce the risk to ALARP.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

Relevant Person concerns were considered regarding this aspect, and the proposed controls will reduce the residual level of risk to Low and ALARP. Therefore, the residual risk associated with the accidental release of treated seawater is considered by Santos to be acceptable.

7.5 Unplanned release: minor hydrocarbons and chemicals

7.5.1 Description of event

Event	Vessels undertaking activities will routinely have a range of chemicals and hydrocarbons onboard, including: • fuel for portable/deck equipment • hydraulic fluid • paints and lubricants • miscellaneous chemicals (e.g. cleaning fluids). An accidental release of minor volumes of chemicals and hydrocarbon liquids into the marine environment has the potential to occur from: • mechanical failure of equipment, such as tank or pipework failure • inadequate handling and storage • insufficient fastening or inadequate bunding • firefighting foam released during an unplanned incident. A release of non-hydrocarbon liquids or chemicals may result in impacts to water quality and hence sensitive environmental receptors.
Extent	Small spills may occur when the chemicals or hydrocarbons are in use or from leaks within the storage area and can potentially be released into the marine environment. The maximum volume of chemicals that could be released during routine operations is likely to be incidental and minor, with bunding in place to retain substances in the event of a leak. Operational experience indicates typical minor spill volumes are <10 L. Dilution from discharges in open waters is rapid, with 1 in 1,000 dilution usually occurring within 30 minutes (Costello and Read, 1994). If the spill is not contained on deck, a release to the marine environment would likely disperse rapidly within the OA. Hydraulic fluid is used in various equipment, such as A-frames, cranes, ROVs and winches. Failure of hydraulic lines may result in the loss of hydraulic fluid to the environment. Operational experience indicates typical volumes released due to hydraulic line failure are <20 L. In the event of a fire emergency, firefighting foam will be used, which would then be discharged directly overboard or through deck drainage systems. The environment that may be affected for non-hydrocarbon liquids or chemical release resulting in a decrease in water quality is likely to be restricted to around the event and contained within the OA.
Duration	The duration of the impact is limited (minutes to hours) to the time the released chemical or hydrocarbon takes to disperse to below harmful concentrations.

7.5.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality); threatened, migratory or local fauna (marine mammals, marine reptiles, fish [including sharks and rays] and birds); socioeconomic; and cultural features.

Hydraulic fluids and lubricating fluids behave similarly to MDO when spilt in the marine environment (see Section 7.6 for information on MDO behaviour in the marine environment). Hydraulic fluids are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and, like MDO, will dissipate quickly, particularly in high sea states. Lubricating oils are more viscous and so their rate of spread from a spill would be slightly slower.

7.5.2.1 Physical environment

Minor volumes of chemicals or hydrocarbons released to the marine environment may lead to contamination of the water column near vessels. The potential impacts would most likely be highly localised and restricted to the immediate area surrounding the spill, with rapid dispersal to concentrations below impact thresholds likely to occur in the open ocean.

Due to the limited volumes and expected rapid dispersal to concentrations below impact thresholds, impacts to water quality are not expected to cause flow-on effects to sediment quality or benthic habitats, including nearby shoals (100 m distant from the OA) are not expected. There is no emergent or intertidal habitats that could be impacted by a surface spill.

7.5.2.2 Threatened, migratory or local fauna

Changes to water quality could potentially lead to short-term impacts on transiting marine fauna (e.g. pelagic fish [including sharks], marine mammals, marine reptiles and seabirds), some of which may have cultural significance as totems or cultural food sources. Only low numbers of animals are expected to be encountered in the OA.

Recovery plans and conservation advice for numerous protected species identify marine pollution and contamination impacts as threats to the species.

Small chemical and hydrocarbon spills are unlikely to have widespread ecological effects on threatened or migratory fauna, given the nature of the chemicals and hydrocarbons onboard, the limited and small volumes that could be released, and the dispersive nature of the open-ocean environment of the OA. Physical coating of marine fauna, in particular those present at the sea surface (e.g. seabirds), by entrained or surface hazardous liquids and sublethal or lethal effects from any accidentally released hydrocarbons is considered unlikely given the expected limited and small potential volumes and short exposure times.

The recovery plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) identified pollution as a threat. However, pollution sources were primarily related to agricultural, terrestrial industrial and domestic sources. The accidental minor chemical and hydrocarbons releases are expected to be of very short duration and localised with no to negligible persistence in the environment.

7.5.2.3 Cultural features

No First Nations people feedback was provided about potential impacts from a minor unplanned release to cultural features during this EP or other Barossa Gas Project EP consultations. In accordance with First Nations people cultural beliefs, if totemic species (e.g. turtles) are impacted by the Activity some believe this in turn can impact First Nations people and make them sick. Section 7.5.2.2 describes the potential impact to marine species of cultural significance.

7.5.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- Zero unplanned release of minor volumes of chemicals and hydrocarbons to the marine environment [EPO-12].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-6 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-6: Control measures evaluation for unplanned release: minor

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	Ensures contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.	Costs associated with personnel time in checking vessel.	**Adopted**
C6.2.5	Vessel planned maintenance system (administrative control)	Reduces leaks from the vessel equipment as it will be operating within its parameters.	Operational costs and labour or access requirements for undertaking maintenance.	**Adopted**
C7.1.3	Chemicals and hydrocarbons will be managed in accordance with standard maritime practices (administrative control)	Reduces the risk of accidental discharge to sea by controlling the storage, handling and clean-up of chemicals.	Cost of implementing procedures.	**Adopted**
C7.5.1	Chemical and hydrocarbon storage areas designed to contain leaks and spills (isolation control)	Reduces the risk of accidental discharge to sea by controlling the storage hydrocarbons.	Cost of implementing procedures.	**Adopted**
C7.5.3	Spill clean-up kits available in high-risk	Reduces the risk of spills and leaks to sea	Cost of implementing procedures.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	areas (protective control)	by controlling the clean-up of minor spills.		
C7.5.4	No perfluorinated sulfonate (PFAS) or perfluorooctane sulfonate (PFOS) will be used in firefighting foam (administrative control)	PFAS and PFOS are persistent, bioaccumulate, and have adverse health effects on humans and wildlife. Safer and environmentally friendly alternatives are available, and efforts are being made to reduce their use and release into the environment.	Cost of implementing procedures.	**Adopted**
C7.5.5	ROV operations undertaken in accordance with good industry practice (administrative control)	Maintenance and pre-deployment inspection on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to the marine environment.	Cost of implementing procedures.	**Adopted**
C7.5.6	Vessel spill response plans (administrative control)	Implements onboard response plans to deal with unplanned hydrocarbon releases and spills quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of demonstrating vessel contractor compliance (e.g. Santos personnel to confirm that a Shipboard Oil Pollution Emergency Plan [SOPEP]/Shipboard marine pollution emergency plan [SMPEP] is in place).	**Adopted**
C7.5.7	Helicopter refuelling procedure (administrative control)	Minimises risk of pollution to ALARP during hydrocarbon transfers to helicopters.	Personnel costs associated with ensuring procedures are in place and implemented during fuel transfers.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Eliminate ROV activities (elimination control)	Eliminates accidental hydrocarbon releases to the marine environment due to equipment failure.	ROVs contain minimal hydrocarbons (<5 L of hydraulic fluid) and as they are inspected and maintained, the risk of failure is very low. Using ROVs in the installation and pre-commissioning activities reduces seabed disturbance, length of time in field, safety and environmental risks.	**Rejected** – not technically or environmentally feasible to eliminate ROV activities. Hydrocarbon releases due to ROV failure has a very low risk and is considered sufficiently managed under ROV inspection and maintenance procedures (refer C7.5.5).
N/A	ROVs to use biodegradable hydraulic fluids only (substitution control)	Using a biodegradable hydraulic fluid reduces potential spill impacts as the oil is less persistent in the marine environment.	ROVs contain minimal hydrocarbons (<5 L of hydraulic fluid) that is likely to be a synthetic blend base oil (inherently biodegradable). ROVs are inspected and maintained,	**Rejected** – based on the cost to replace or modify the ROVs. The synthetic blend base oil that may be released due to ROV failure has a very low risk and is

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
			and the risk of failure is considered very low.	considered sufficiently managed under ROV inspection and maintenance procedures (refer to C7.5.5).

7.5.4 Environmental impact assessment

Receptors	• Physical environment (water quality) • Threatened, migratory or local fauna (marine mammals, marine reptiles, fish [including sharks and rays] and birds) • Socioeconomic (commercial fishing, tourism and recreation) • Cultural features
Consequence	I – Negligible
If a chemical is spilt, the largest spill would likely be less than 10 L. Impacts to water quality would be expected to be very short-term and localised given the limited volumes that could be spilled. Due to the dispersive nature of the ocean environment and water depths within the OA, impacts to benthic habitats, including Shepparton Shoal are not predicted. The water foaming agents in aqueous film forming foam (AFFF) may be harmful to marine organisms. Most of these foams have high oxygen demand and the toxicity of the detergents, solvents and other components in the foams may result in adverse effects to marine organisms. However, these effects are greatly diminished in the offshore marine environment due to the natural dilution from wind, wave and currents. The release of these foams is restricted to an emergency event. If a minor hydrocarbon spill occurs, the quantities would likely be limited to 20 L. The small volumes, dilution and dispersion from natural weathering processes such as ocean currents and evaporation are such that spills will be limited in area and duration. The susceptibility of marine fauna to hydrocarbons depends on hydrocarbon type and exposure duration; however, given that exposures would be limited in extent and duration, exposure to marine fauna from this potential hazard is considered very low. The small volumes of worst-case discharges are such that the potential for impacts to receptors will decline rapidly with time and distance at the sea surface. Harmful effects are not expected to the benthic community due to the water depths. Near the sea surface, fish can detect and avoid contact with surface slicks and, as a result, fish mortalities rarely occur in open waters from surface spills (Kennish, 1997; Scholz et al., 1992). Therefore, pelagic fish species (e.g. sharks) are generally not highly susceptible to impacts from hydrocarbon spills. In offshore waters near the release point, pelagic fish are at risk of exposure to the more toxic aromatic components of the hydrocarbons. However, pelagic fish in offshore waters are highly mobile; therefore, it is unlikely they would be exposed to toxic components for long periods in this spill scenario. Components with higher toxicity would also rapidly evaporate and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. Marine pollution is identified as potential threats to several marine fauna species (that may be present in the OA) in relevant recovery plans and conservation advice (Table 3-13) and to MNES (DAWE, 2022b). Given the negligible consequence on the physical environment or species, subsequent impacts to socioeconomic receptors (including commercial fishing, tourism and recreation) and cultural features are not anticipated. A very small (less than 20 L) chemical or hydrocarbon spill would not result in a decreased population size at a local or regional scale or long-term reduction to water and sediment quality, but may be detectable, it is expected that a spill of this nature would result in I – Negligible consequence.	
Likelihood	D – Occasional
The likelihood of releasing minor volumes of chemicals (<10 L) or hydrocarbons (<20 L) to the environment during routine operations is considered D – Occasional.	
Residual Risk	The residual risk is considered Low.

7.5.5 Demonstration of as low as reasonably practicable

Storing and using chemicals, hydraulic and lubricating oils/fluids for equipment and machinery, including for ROV operations, is required to undertake the Activity, so their removal from the Activity is not viable.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.5.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked as Low.

Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – while several plans identify pollution as a threat to marine fauna, negligible impacts are predicted for this Activity.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), *Navigation Act 2012 (Cth),* MARPOL Annex V and Marine Order 91 (Marine pollution prevention – oil). Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – no objections or claims were raised regarding a potential minor release.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

No Relevant Person concerns have been raised regarding this aspect, and the proposed controls will reduce the residual level of risk to Low and ALARP. Therefore, the residual risk associated with the accidental release of minor volumes of chemicals and hydrocarbons is considered by Santos to be acceptable.

7.6 Unplanned release: MDO

7.6.1 Description of event

Event	**Worst-case credible MDO release** A credible worst-case release scenario of MDO to the marine environment could be a collision between 2 activity vessels or an activity vessel and a third party. Such a collision could rupture a fuel tank at the sea surface resulting in the release of MDO to sea. A vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather. The AMSA (2015) Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities recommend that the spill scenario for modelling and impact assessment should be based on 50% of the largest single fuel tank volume if protected by a double–hull or the largest single unprotected fuel tank volume. A typical pipelay vessel, such as *Audacia*, has a 1,118 m^3 MDO fuel tank with double–hull wing protection equivalent and hence a spill scenario volume of is 559 m^3. This is considered the largest spill scenario volume across the activity vessel fleet. Santos took a conservative approach and used a larger MDO volume of 700 m^3 for this assessment, based on a previously modelled scenario by RPS (2021). **Bunkering incident** Also considered in this section is a much smaller volume refuelling incident (fuel hose failure or rupture, coupling failure or tank overfilling) where vessel or helicopter fuel bunkering would need to be stopped manually. Fuel released before pumping stops and fuel remaining in the transfer line may be released to the environment. Spill volumes were determined from transfer hose inventory and spill prevention measures, including 'dry-break' or 'breakaway' couplings, rapid shutdown of fuel pumps and spill response preparedness, with 10 m^3 considered to be the maximum volume that could be released from the hose before shutdown.
Extent	Spill trajectory modelling calculated from amalgamating 300 spill simulations (RPS, 2021) predicted that there was some probability of a 700 m^3 MDO release extending as follows: • moderate exposure thresholds: – probability of shoreline accumulation was highest during summer conditions (maximum probability of 5%) with transitional and winter seasons with a maximum of 1%. No shoreline accumulation occurred at high exposure values. – surface oil was predicted to occur within 40 km east south-east of the release location – entrained oil (1-hour time-step, high exposure value) was predicted to occur within 135 km of the release location – dissolved hydrocarbons (1-hour time-step) were predicted within approximately 23 km of the release location. • low exposure thresholds: – probability of shoreline accumulation was highest during summer conditions (maximum probability of 43%) with transitional (16%) and winter seasons (2%). – surface oil was predicted to occur within 85.8 km west from the release location. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill.
Duration	A 700 m^3 release of MDO was modelled for a release over 6 hours. MDO is expected to weather quickly through evaporation and dispersion and is unlikely to persist in the environment. Modelling over 6 hours was applied to the model settings in order to be consistent with the GEP EP spill modelling. This approach is considered conservative as most contemporary models use an instantaneous duration (1-hr time step) (NOPSEMA, 2019).

7.6.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality, shoals and banks, benthic habitats), threatened or migratory fauna (marine mammals, marine reptiles, fish [including sharks and rays] and birds), protected areas (AMPs and KEFs), socioeconomic receptors (fisheries, tourism, recreation and other third-party operators); and cultural features (including Native Title, ILUAs, sacred sites and sea country).

A hydrocarbon release will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon release depends on the magnitude of the release (i.e. extent, duration), prevailing weather conditions and sensitivity of the receptor. The nature and scale of a hydrocarbon release is described throughout this section for a vessel collision scenario, given smaller hydrocarbon releases (from refuelling) will impact a smaller area than a vessel collision.

7.6.2.1 Stochastic spill dispersion modelling

The MDO spill modelling assessed the fate of the released hydrocarbons and their potential impact upon the environment. The subsections below summarise the findings of the modelling.

Modelled MDO

MDO is a group II light-persistent fuel used in the maritime industry (ITOPF, 2022). The classification is based on the MDP specific gravity in combination with relevant boiling point ranges. It has a low viscosity (4 cP), which indicates that this hydrocarbon will spread quickly when spilt at sea. MDO will have a thin to low thickness level on the sea surface, which increases the rate of evaporation. Table 7-7 lists the MDO characteristics used in the modelling.

Table 7-7: Characteristics of MDO

Density at 25 °C (kg/m³)	API gravity	Viscosity at 25 °C (cP)	Component boiling point (°C) % of total			
			Volatile (%) <180	Semi-volatile (%) 180–265	Low volatility (%) 265–380	Residual (%) >380
829	37.6	4	6	35	54	5

Source: RPS, 2023b

Hydrocarbon fate and weathering

MDO is characterised by a high percentage of volatile components (95%), which will evaporate when on the sea surface over several days, depending upon the prevailing conditions. It also contains 5% persistent hydrocarbons, which will not evaporate, though will decay over time (Table 7-7). The heavier components of MDO tend to become entrained into the upper water column as oil droplets in the presence of breaking waves and moderate winds (i.e. >12 knots) but can refloat to the surface if these energies abate. Entrained MDO is largely concentrated in surface waters (0–10 m deep) (RPS, 2023b).

Generally, the mass balance forecast for the calm-wind speed case predicts that approximately 36% of the MDO will evaporate within 24 hours. The majority of the remaining MDO on the sea surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and then be subject to biological and photochemical degradation (RPS, 2023b). Under variable-wind speeds where the winds are of greater strength on average, MDO entrainment is predicted to increase. Generally after approximately 24 hours, approximately 80% of the MDO is forecast to have entrained and a further 15% is forecast to have evaporated, leaving only a small proportion on the water surface (<1%) (RPS, 2023b). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

International Tanker Owners Pollution Federation (2011) categorise MDO as a light ‘group II’ hydrocarbon. In the marine environment, a 5% residual of the total quantity of MDO spilt will remain after the volatilisation and solubilisation processes associated with weathering. In the marine environment, MDO is expected to behave as follows:

- spread rapidly in the direction of the prevailing wind and waves.
- evaporation will be the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance.
- evaporation rate will increase in warmer air and sea temperatures.
- residues usually consist of heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

Modelling methods

The modelling was done in several stages. Firstly, the tidal currents for the region were generated using the RPS ocean/coastal model, HYDROMAP. Secondly, large-scale ocean currents were obtained from a large-scale ocean model for the same region and combined with tidal currents. The hybrid ocean/coastal model was used to describe the total water movement within the region. Finally, the 2013–2017 current and local wind data were used as inputs in the oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilt hydrocarbon. The model considered the fates described above in Hydrocarbon Fate and Weathering.

Exposure probabilities were determined using a stochastic modelling approach, which aggregates the behaviour of multiple random spill simulations for each of the 3 representative seasons (wet, dry and a transitional period). Each simulated spill starts at a different time of day to ensure that the predicted transport and weathering of each spill trajectory was subjected to varying wind and current conditions. A total of 100 model runs were conducted for each season, with the total stochastic dataset comprising 300 model runs for the release location.

The model results were combined to summarise each season to determine the annualised potential exposure to the surrounding waters, shorelines and sensitive receptors based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA, 2019). This output does not represent the potential behaviour of a single spill (which would have a much smaller area of effect); instead, it indicates the probability of any given area of the sea being contacted by hydrocarbons at a particular concentration (see Table 7-9). It is important to note that some model settings were conservatively applied in order to be consistent with the GEP EP spill modelling approach such as the release duration and spill volume. Table 7-8 summarises the model settings and assumptions.

Table 7-8: Summary of model settings and assumptions for the vessel collision scenario

Parameter	Scenario
Scenario description	A fuel tank rupture caused by a vessel collision
Location	Commonwealth/NT waters boundary (refer to Table 2-2 for coordinates)
Number of randomly selected spill start times	300 total (100 per season)
Oil type	MDO
Spill volume*	700 m^3
Release duration**	6 hours
Simulation length	50 days

**Noting, largest spill scenario volume across the activity vessel fleet is 559 m^3.*

Hydrocarbon exposure thresholds

To inform the environmental assessment it is important to understand the profile of the concentrations of hydrocarbons after a spill. To do this NOPSEMA recommends identifying hydrocarbon exposure values that broadly reflect the range of consequences that could occur at certain concentrations (NOPSEMA, 2019). The exposure values that have been applied to this EP are provided in Table 3-1.

To identify appropriate exposure values Santos has followed the advice provided by NOPSEMA in Bulletin #1 Oil Spill Modelling (2019) and scientific literature. The selected hydrocarbon exposure values are discussed in Table 7-9 to Table 7-10. These tables explain how the exposure value is relevant to the risk evaluation and provides context on how that exposure value is used to inform response planning (which is addressed further in the OPEP [BAS-210 0131]).

Determining exposure values that may be representative of biological impact is complex since the degree of impact will depend on the sensitivity of the receptors contacted, the duration of the exposure and the toxicity of the hydrocarbon type making the contact. The toxicity of a hydrocarbon will also change over time, due to weathering processes altering the composition of the hydrocarbon.

To inform the environmental assessment, exposure values that may be representative of biological impact have also been identified for the worst-case spill scenario. These are called moderate exposure values (defined by the MEVA; Table 7-9) and illustrated in Figure 7-6. The spatial extent of the high exposure values are contained within the MEVA boundary. Moderate and high exposure values are modelled for each fate of hydrocarbon to identify what contact is predicted for surface (floating hydrocarbons), subsurface (entrained hydrocarbons and dissolved aromatic hydrocarbons), and shoreline accumulation of hydrocarbon at sensitivities.

The low exposure values (Table 3-1) are used as a predictive tool to set the outer boundaries of the EMBA from the worst-case spill scenario shown in Figure 3-2. This results in a highly conservative and comprehensive basis to plan and prepare for spill response, particularly scientific monitoring. These low exposure values are not considered to be representative of a biological impact, but they are adequate for identifying the full range of environmental receptors that might be contacted by surface and/or subsurface hydrocarbons (NOPSEMA, 2019) and a visible sheen may be apparent. The low exposure values for surface and shoreline accumulation (Table 7-10) are used as a predictive tool to approximate a range of potential socioeconomic effects (visual amenity may be affected) and the predicted maximum spatial extent is illustrated in Figure 7-5.

Table 7-9: Moderate exposure value areas (MEVA) thresholds

Exposure zone	Threshold	Justification
Surface hydrocarbon		
Moderate exposure (10–25 g/m²)	10 g/m²	Ecological impact has been estimated to occur at 10 g/m² (a film thickness of approximately 10 µm or 0.01 mm) as this level of oiling has been observed to mortally impact birds and other wildlife associated with the water surface (French et al., 1996; French-McCay, 2009). This approximates the lower limit for harmful exposures to birds and marine mammals.

Exposure zone	Threshold	Justification
		Contact within this exposure zone may result in impacts to the marine environment and therefore was used to define the MEVA.
Entrained hydrocarbon		
High exposure (100–500 ppb)	100 ppb/over 1 hour	The 100 ppb threshold is considered conservative in terms of potential for toxicity effects leading to mortality for sensitive mature individuals and early life stages of species. This threshold indicates a potential zone of acute exposure, which is more meaningful over shorter exposure durations. The 100 ppb threshold contact within this exposure zone may result in impacts to the marine environment. The high exposure for entrained hydrocarbons was used to define the MEVA.
Dissolved aromatic hydrocarbon		
Moderate exposure (50–100 ppb)	50 ppb/over 1 hour	A conservative threshold of 50 ppb was chosen as it was more likely to indicate potentially harmful exposure to fixed habitats over short exposure durations (French-McCay, 2002). Contact within this exposure zone may result in impacts to the marine environment. This level may have potential toxic effects, particularly sublethal effects to sensitive species.
Shoreline accumulation		
Moderate accumulation (100–1,000 g/m²)	100 g/m²	Accumulated hydrocarbons above 100 g/m² may coat an animal in the intertidal range and likely impact its survival and reproductive ability (affected animals include invertebrates, marine mammals, marine reptiles and shorebirds). This threshold is the minimum thickness that can be cleaned up that does not inhibit the potential for recovery. The 100 g/m² threshold was selected to define the moderate accumulation zone and threshold for adverse shoreline accumulation. Accumulation on shorelines above this threshold may result in impacts to the marine environment.

Table 7-10: Socioeconomic exposure thresholds

Exposure zone	Threshold	Justification
Surface hydrocarbons		
Low exposure	1 g/m²	It is recognised that a lower surface oil concentration of 1 g/m^2 (equivalent to a thickness of 0.001 mm or 1 ml of oil per m^2) is visible as a rainbow sheen on the sea surface. Although this is lower than the threshold for ecological impacts, it may be relevant to socioeconomic receptors and has been used as the exposure value to define the spatial extent of the environment that might be contacted from surface hydrocarbons.
Shoreline accumulation		
Low accumulation (10–100 g/m²)	10 g/m²	An accumulated concentration of oil above 10 g/m^2 on shorelines is considered to represent a level of socioeconomic effect (NOPSEMA, 2019). This equates to 10 mL (or 2 teaspoons) of oil per m^2. This may result in a reduction in visual amenity of shorelines. This value has been used in previous studies to represent a low contact value for interpreting shoreline accumulation modelling results (French-McCay, 2005, 2006).

Modelling results

The regional currents are dominated by tidal and wind-driven currents, which vary according to the season. These will influence the direction that the hydrocarbons (entrained and surface) travel in a particular season.

Modelling results predict that surface hydrocarbons may extend up to 40 km east-southeast during wet season conditions above moderate exposure value (10 g/m^2). The maximum extent at the high exposure threshold (>25 g/m^2) from the release location was 27.5 km (north-west). The maximum extent at the low exposure threshold (1 g/m^2) from the release location was up to 86 km (west).

The maximum probability of shoreline accumulation was 5% during summer conditions, and 1% during the transitional and winter seasons above moderate exposure value (100 g/m^2) with a minimum time of 5.29 days before shoreline contact was predicted during winter conditions. Vernon Islands (3%), Melville Island (1%) and Cox Finniss (1%) were also predicted to have shoreline accumulation during the summer season only. The maximum

probability of shoreline accumulation was 43% during summer conditions, and 16% during the transitional and 2% during winter seasons above low exposure value (10 g/m^2) with a minimum time of 4 days before shoreline contact was predicted during winter conditions.

Entrained hydrocarbons above moderate exposure value (100 ppb, 1 hour) may extend up to 127.3 km (summer), 82.6 km (winter) and 134.5 km (transitional) from the release location. Dissolved aromatics above moderate exposure value (50 ppb) were predicted to extend up to approximately 23 km in summer, 24.3 km winter and 11.2 km (transitional).

7.6.2.2 Deterministic spill dispersion modelling

The stochastic simulation output provides a probabilistic temporal and spatial representation of a spill incident. Individual stochastic realisations were selected to run in deterministic mode. The deterministic simulations were selected by identifying the stochastic realisations from each scenario that resulted in the maximum volume of ashore and longest shoreline contacted.

Maximum volume of MDO ashore

From the 300 simulations, the spill starting at 5 pm on 25 February 2016 during the wet season conditions was identified to cause the greatest volume of oil ashore.

Figure 7-1 shows the hydrocarbon exposure on the sea surface and maximum shoreline loading for the identified spill simulation over the 50-day simulation. Figure 7-2 illustrates the fates and weathering graph for the spill simulation (RPS, 2021). By the end of the simulation, approximately 605 m^3 (86% of the total release volume) and 58 m^3 (8%) of the MDO was predicted to have evaporated and decayed, respectively, while approximately 22 m^3 (3%) was predicted to remain in the water column. Additionally, at the end of the simulation, 2 m^3 (0.3%) remained on the water surface and 12 m^3 (2%) was predicted to remain ashore. The maximum volume of MDO ashore modelled:

- maximum distance (at or above 10 g/m² threshold) of 42.5 km east of the release location was predicted
- initial shoreline contact was predicted to occur 9.5 days after commencement of the release
- shoreline accumulation (at or above 10 g/m² threshold) was predicted for regions east and south-east of the release location, specifically along the shorelines adjacent to Fanny Bay, Shoal Bay Coastal Reserve, Gunn Point, South West Vernon Island and Tapa Bay, Shoal Bay, Ida Bay, respectively
- shoreline accumulation (at or above 100 g/m² threshold) was predicted at the shoreline north of Tapa Bay
- no shoreline accumulation at or above 1,000 g/m² threshold.

Longest shoreline contacted

From the 300 simulations, the spill starting at 7 pm on 23 May 2016 during the dry season conditions was identified to cause the longest stretch of shoreline contacted by hydrocarbons (RPS, 2021).

Figure 7-3 shows the hydrocarbon exposure on the sea surface and maximum shoreline loading for the identified spill simulation over the 50-day simulation.

Figure 7-4 illustrates the fates and weathering graph for the spill simulation (RPS, 2021). By the end of the simulation, approximately 605 m^3 (86% of the total release volume) and 58 m^3 (8%) of the oil was predicted to have evaporated and decayed, respectively, while approximately 26 m^3 (4%) was predicted to remain in the water column. Additionally, at the end of the simulation 1 m^3 (0.1%) remained on the water surface and 8 m^3 (1%) was predicted to remain ashore. For the longest shoreline contacted modelled:

- surface hydrocarbon exposure (at or above 1 g/m² threshold) was predicted to occur north from the release location and immediately adjacent to Cape Fourcroy and the neighbouring southern shorelines of Bathurst Island
- surface hydrocarbon exposure (at or above 10 g/m² threshold) was predicted to occur predominantly north of the release location at maximum distances of 26.7 km
- initial shoreline contact was predicted to occur 3.7 days after commencement of the release
- shoreline accumulation (at or above 10 g/m² and 100 g/m² thresholds) was predicted for the south-western shoreline of Bathurst Island
- no shoreline accumulation at or above 1,000 g/m² threshold.

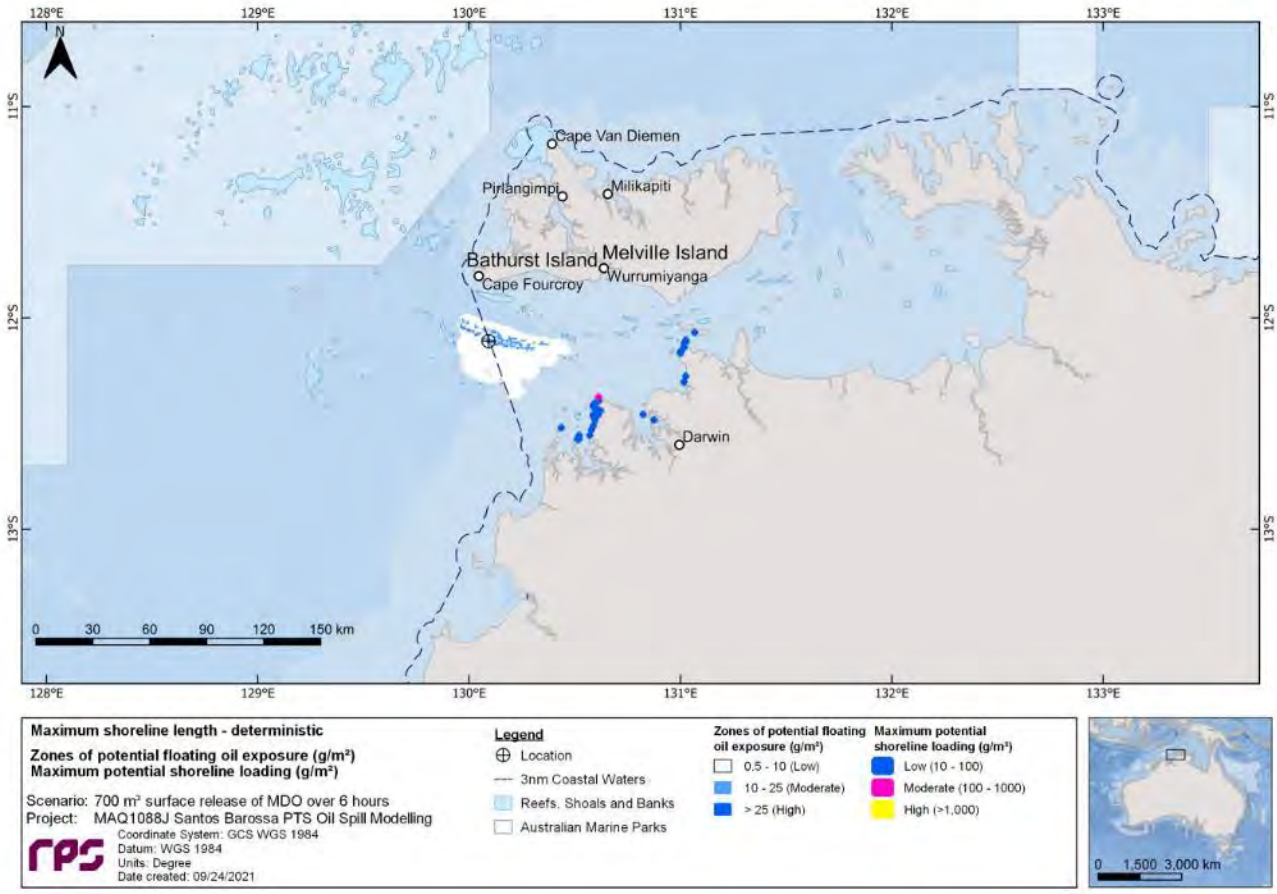


Figure 7-1: Floating oil (surface) exposure and maximum shoreline loading over 50-days for the greatest volume of oil ashore simulation from all 300 simulations

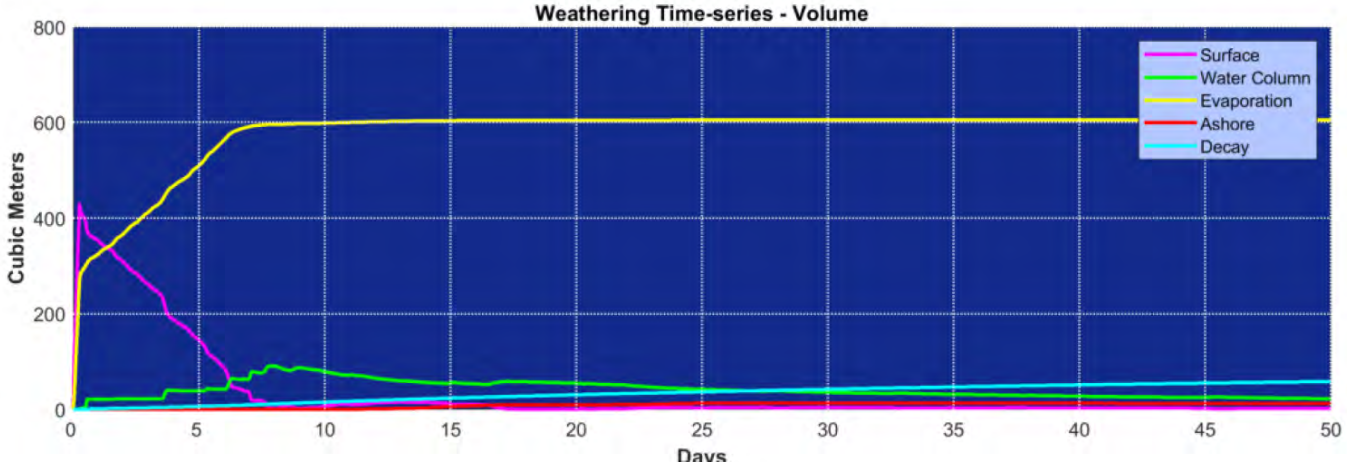


Figure 7-2: Predicted weathering and fates for the greatest volume ashore simulation from all 300 simulations (RPS, 2021)

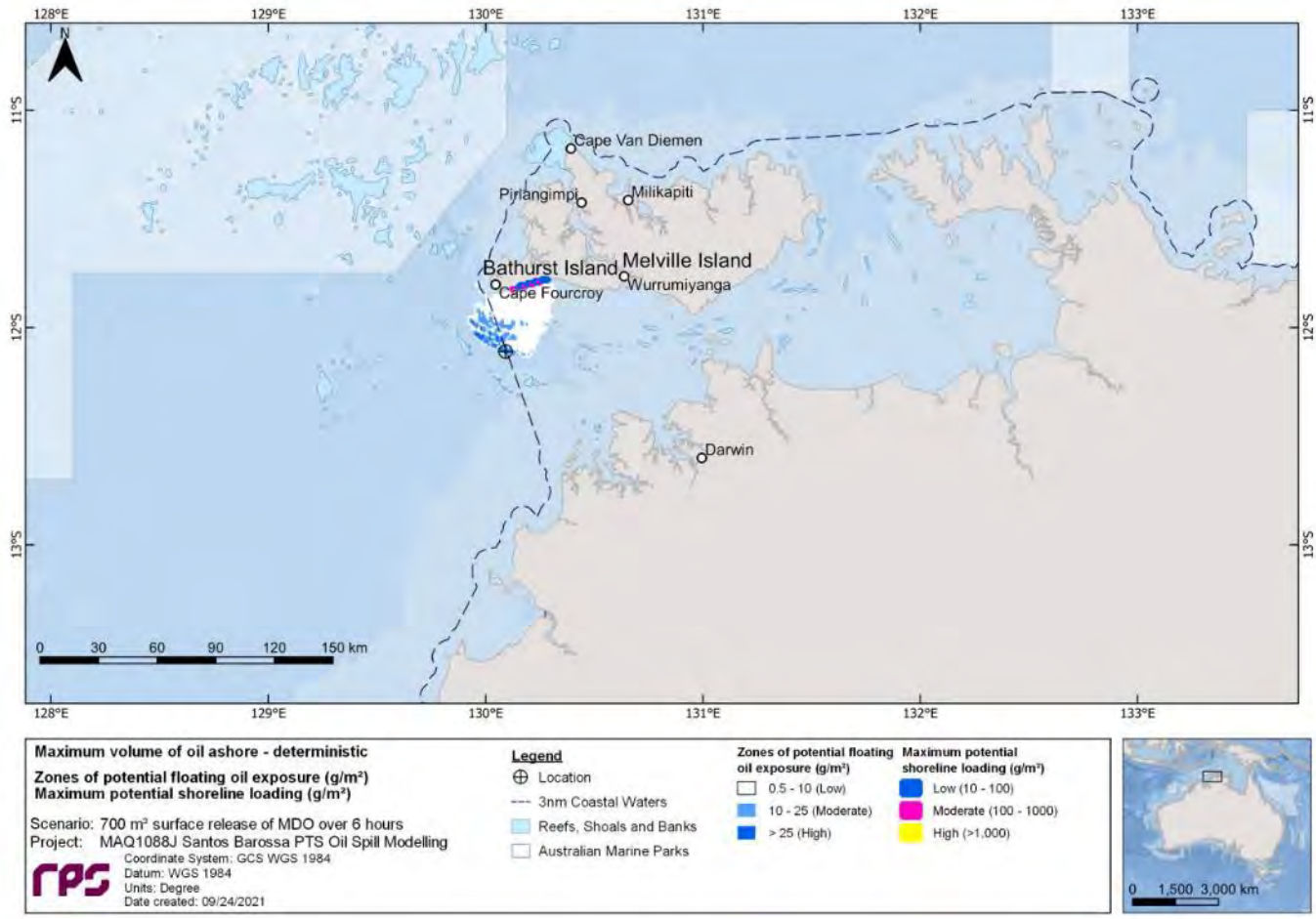


Figure 7-3: Floating oil (surface) exposure and maximum shoreline loading over 50-days for the longest stretch of shoreline contacted by hydrocarbon simulation from all 300 simulations

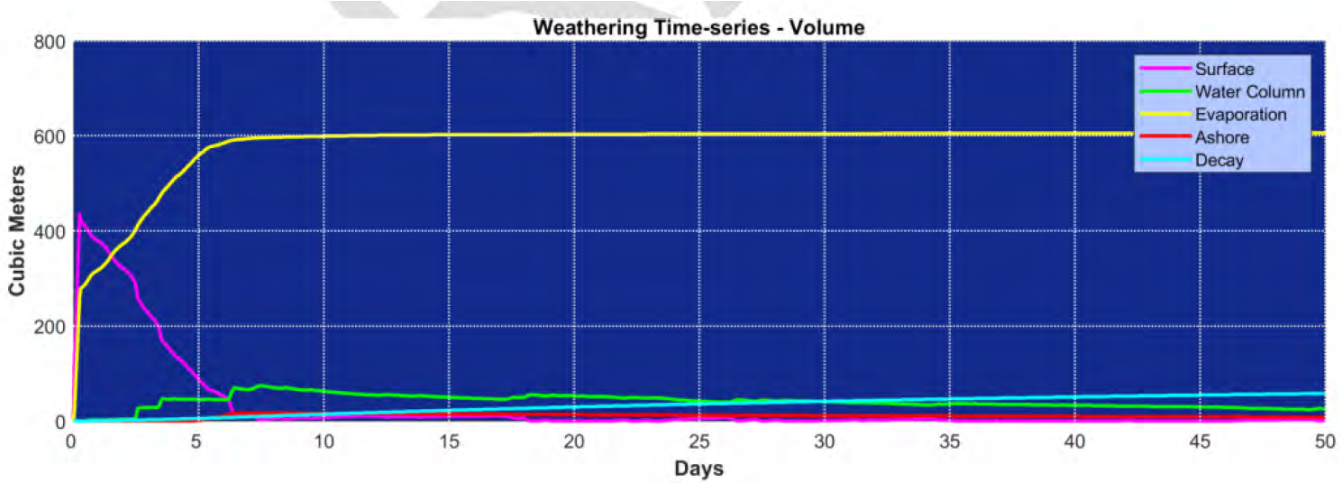


Figure 7-4: Predicted weathering and fates for the longest stretch of shoreline contact simulation from all 300 simulations (RPS, 2021)

7.6.2.3 Potential hydrocarbon impact pathways and nature and scale of impact

To help inform the hydrocarbon spill risk assessment receptors within the EMBA, potential impact pathways have been defined (Table 7-11). The potential impact pathways consider physical and chemical pathways. Physical pathways include contact from surface hydrocarbons, accumulated shoreline hydrocarbons, or entrained hydrocarbon droplets. Table 7-11 summarises the chemical pathways (e.g. ingestion, inhalation or contact) from any hydrocarbon phase and used to inform the risk assessment.

Table 7-11: Physical and chemical pathways for hydrocarbon exposure and potential impacts to receptors

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Seagrasses and macroalgae	Coating of leaves/thalli reducing light availability and gas exchange. Degree of coating depends upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the hydrocarbons.	Bleaching or blackening of leaves. Defoliation. Reduced growth.	External contact by hydrocarbons and adsorption across cellular membranes.	Mortality. Bleaching or blackening of leaves. Defoliation. Disease. Reduced growth. Reduced reproductive output. Reduced seed/propagule viability.
Hard corals (coral reefs)	Coating of polyps, shading resulting in reduction on light availability. Degree of coating is dependent upon the metocean conditions, dilution, if corals are emergent at all and continual weathering of the hydrocarbons.	Bleaching. Increased mucous production. Reduced growth.	External contact by hydrocarbons and adsorption across cellular membranes.	Mortality. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg/larval success. Growth abnormalities.
Non-coral benthic invertebrates	Coating of adults, eggs and larvae. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the hydrocarbons.	Mortality. Behavioural disruption. Impaired growth.	Ingestion. External contact and adsorption across exposed tissues and cellular membranes. Uptake of DAH across cellular membranes. Reduced mobility and capacity for oxygen exchange.	Mortality. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg/larval success. Growth abnormalities. Behavioural disruption.
Sharks, rays and fish	Coating of adults but primarily eggs and larvae – reduced mobility and capacity for oxygen exchange.	Mortality. Oxygen debt. Starvation. Dehydration. Increased predation. Behavioural disruption.	Ingestion. External contact and adsorption across exposed skin and cellular membranes. Uptake of DAH across cellular membranes (for example, gills).	Mortality. Cell damage. Flesh taint. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
				Reduced reproductive output. Reduced egg/larval success. Growth abnormalities. Behavioural disruption.
Birds (seabirds and shorebirds)	Contact with the surface hydrocarbons resulting in coating. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the hydrocarbons.	Feather and skin irritation and damage, with the potential to cause secondary impacts such as: • physical restriction of flight and swimming movement • mortality • hypothermia/impairing the waterproofing of feathers • disruption to feeding/ starvation • disruption to breeding • disruption to migration.	Ingestion (during feeding or preening). External contact and adsorption across exposed skin and membranes. Inhalation.	Mortality. Cell damage, lesions. Secondary infections. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Growth abnormalities. Behavioural disruption.
Marine reptiles	Contact with the surface hydrocarbons resulting in coating. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the hydrocarbons.	Irritation of eyes/mouth and potential illness, which may cause secondary impacts such as: • mortality • disruption to feeding/ starvation • physical restriction • behavioural disruption.	Inhalation. Ingestion. External contact and adsorption across exposed skin and membranes.	Mortality. Cell damage, lesions. Secondary infections. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced hatchling success. Reduced reproductive output. Growth abnormalities. Behavioural disruption.
Marine mammals	Coating of feeding apparatus in some species (baleen whales) from exposure to surface hydrocarbons. Potential to coat the sensory hairs around the mouths of dugongs which can impact feeding.	Irritation of eyes/mouth, damage to fur and potential illness, which may cause secondary impacts such as: • mortality • disruption to feeding/ starvation • physical restriction	Inhalation. Ingestion. External contact and adsorption across exposed skin and membranes.	Mortality. Cell damage, lesions. Secondary infections. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
		• behavioural disruption.		Growth abnormalities. Behavioural disruption.
Plankton	Coating of feeding apparatus. Reduced mobility and capacity for oxygen exchange.	Mortality. Behavioural disruption (for example, reduced mobility).	Ingestion. External contact.	Mortality. Impairment of biological activities (for example, feeding, respiration). Reduced mobility.
Water quality and sediment quality	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Degree of loading in the water column is dependent upon the influence of wave energy and tidal currents.	Impacts to flora and fauna, as discussed in rows above.	Adsorption via cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation. Impacts to flora and fauna, as discussed in rows above.	Impacts to flora and fauna, as discussed in rows above.
Protected areas	Coating of benthic habitats and marine fauna/flora within protected areas as discussed in rows above.	Mortality, injury or behavioural disruption to marine biota. Impairment of habitats within protected areas. Reduction in the quality of the marine environment within protected areas. Environmental value of protected areas is degraded.	Impacts to flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine biota. Impairment of habitats within protected areas. Reduced growth of benthic habitats. Reduction in the quality of the marine environment within protected areas. Environmental value of protected areas is degraded.
Socioeconomic environment (commercial and recreational fisheries, recreation & tourism, shipping, defence)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Presence of weathered hydrocarbon on the shoreline.	Degradation of UCH sites. Disruption to tourism, recreation, shipping, defence or energy industry activities. Displacement of commercial or recreational fishing. Reduction in natural resources.	Impacts to water quality, sediment quality, flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna relevant to commercial and recreational fisheries or to tourism. Loss or degradation of habitats within protected areas. Reduced growth of benthic habitats. Reduction in the quality of the marine and shoreline environment within protected areas. Socio-economic value of protected areas is degraded.

Receptor	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Cultural features (native title, ILUAs, IPAs, sacred sites, marine parks, cultural fishing, hunting and gathering and sea country)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Presence of weathered hydrocarbon on the shoreline.	Hydrocarbons may be present in areas with cultural features (e.g. ILUAs, IPAs, sacred sites, marine parks, cultural fishing, hunting and gathering and sea country). Displacement of traditional uses of environment. Reduction in natural resources with cultural significance.	Impacts to water quality, sediment quality, flora and fauna, as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna that has cultural significance. Loss or degradation of habitats of cultural value. Reduction in the quality of the marine and shoreline environment, including environment with cultural significance. Cultural value of cultural features is degraded.

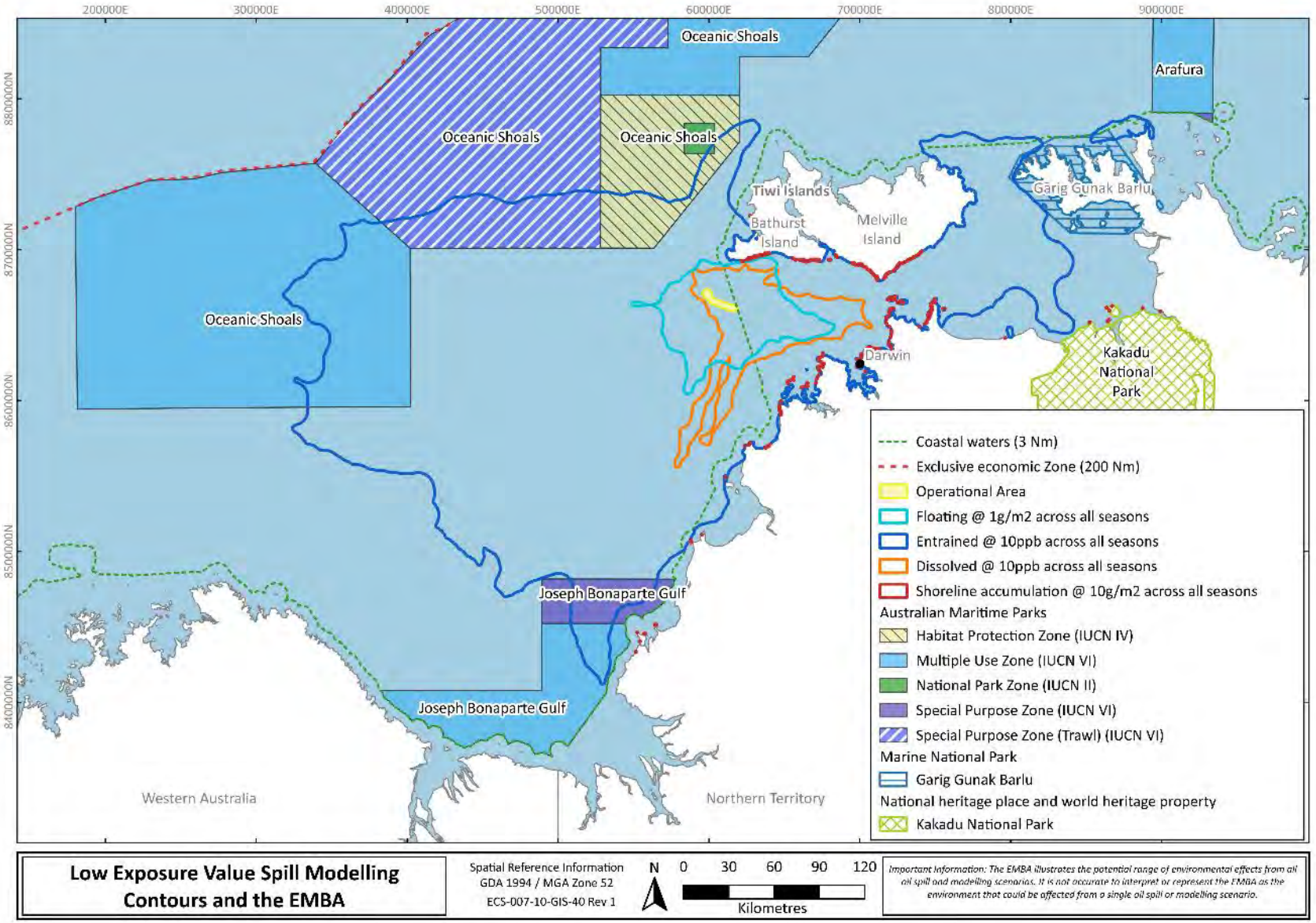


Figure 7-5: Low exposure threshold spill modelling contours and sensitive receptors, derived from all 300 spill simulations

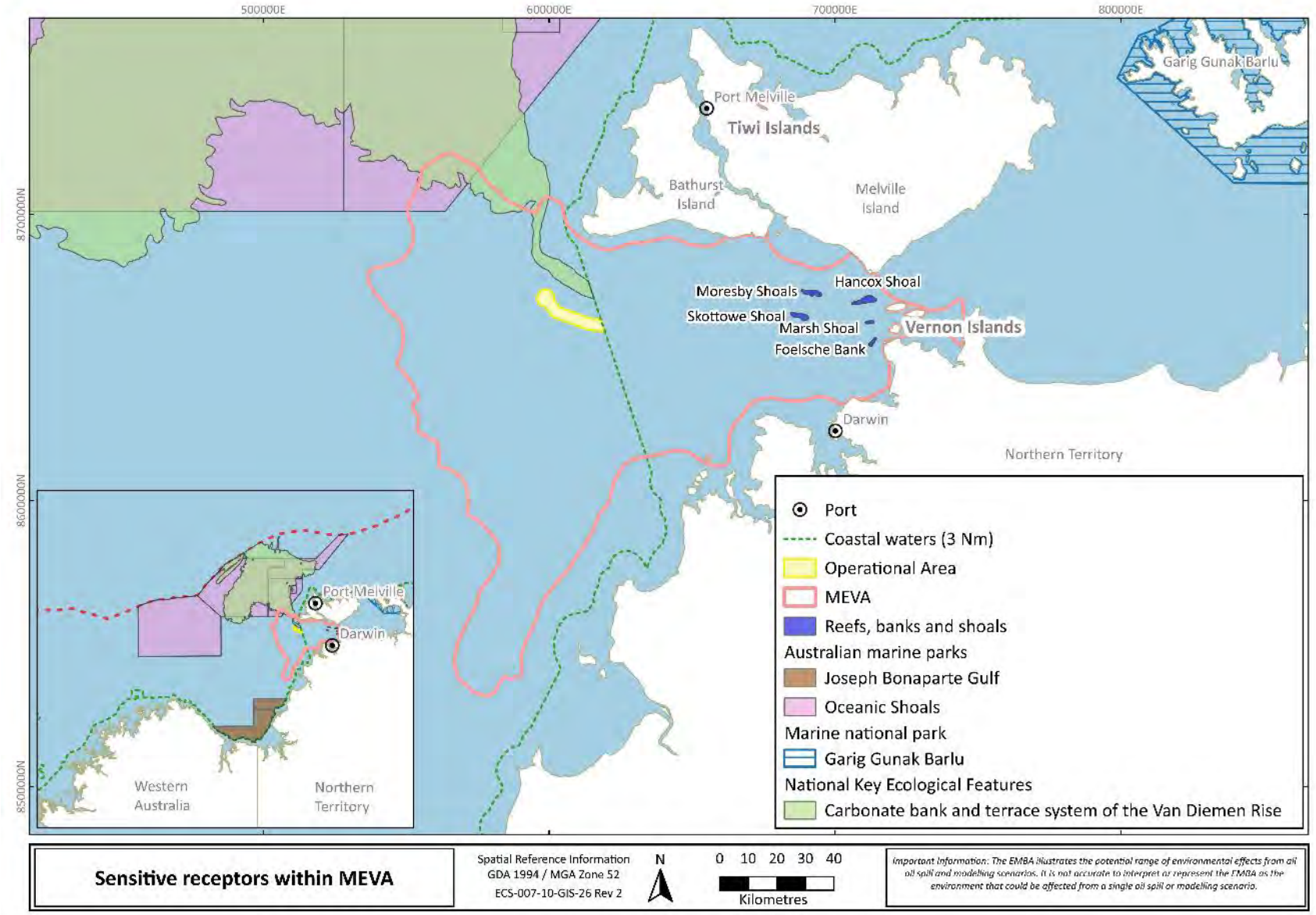


Figure 7-6: Sensitive receptors contacted by moderate exposure values, derived from all 300 spill simulations

7.6.3 Environmental performance outcomes and control measures

The EPOs relating to this event include:

- No MDO release to the marine environment [EPO-13]
- No significant impacts to cultural features from the Activity [EPO-14].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-12 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Selection of oil spill response strategies and associated performance outcomes, control measures and performance standards, including those required to maintain preparedness and for response, are detailed within the OPEP (BAS-210 0131). The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-12: Control measures evaluation for hydrocarbon release – MDO

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	Ensures contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements. Ensures vessels meet Marine Assurance Standards to reduce the likelihood of vessel collision (such as minimum and working lighting for maritime safety).	Costs associated with personnel time in checking vessel.	**Adopted**
C6.1.2	Undertake consultation with Relevant Persons (including applicable notifications) (administrative control)	Alerts other marine users to the presence of: • activity vessels and the relatively slow speed and restricted manoeuvrability of these vessels • 500 m exclusion zone around the installation vessels thus reducing the likelihood of vessel collision.	Limited additional costs to Santos. Stakeholders' time required to review consultation material and communicate with Santos.	**Adopted**
C6.1.3	The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes (administrative control)	Santos marine vetting process, thus reducing the potential for interaction and collision.	Cost associated with implementing procedures.	**Adopted**
C6.1.5	Vessel speed restrictions within the operational area (substitution control)	Vessel speeds within the OA will be limited to ≤8 knots to reduce the consequence of vessel-to-vessel collision impacts. Reduces the potential impacts to culturally significant marine	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		species, including totemic species, such as marine turtles and marine mammals.		
C6.1.6	One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay (administrative control)	A vessel will be in the immediate vicinity of the pipelay vessel to act as a surveillance and intervention vessel. The vessel will mitigate potential interactions between the pipelay vessel and other marine users and hence reduce the likelihood of a collision.	Cost associated with implementing procedures.	**Adopted**
C6.2.5	Vessel planned maintenance system (administrative control)	Reduces risk of vessel collision and refuelling incidents because equipment is operating within planned maintenance requirements.	Operational costs and labour or access requirements of undertaking maintenance.	**Adopted**
C7.5.6	Vessel spill response plans (administrative control)	Implements onboard response plans to deal with unplanned hydrocarbon releases quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/ SMPEP in place. Administrative costs of demonstrating vessel contractor compliance (e.g. Santos personnel to confirm that a SOPEP/SMPEP is in place).	**Adopted**
C7.6.1	No IFO or HFO will be used in activity vessels (elimination control)	Using MDO rather than a 'heavier' fuel type reduces potential spill impacts as MDO is less persistent in the marine environment.	Additional assurance costs of ensuring vessels are using the required fuel.	**Adopted**
C7.6.2	Accepted OPEP (administrative control)	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Personnel and administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of OPEP.	**Adopted**
C7.6.3	Vessel-specific bunkering procedures and equipment consistent with Santos marine vessel vetting requirements (administrative control)	Minimises risk of pollution to ALARP during refuelling.	Personnel costs associated with ensuring procedures are in place and implemented during refuelling.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and	Ensures that crew are aware of the stringent	Administrative costs to update existing Santos procedure and induction	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	cultural values (administrative control)	EP, Santos and legislative requirements.	materials and train personnel.	
N/A	No fuel bunkering via hose (elimination control)	Removes spill risk from hose operations.	Cost associated with transfer of MDO via drums or containers and introduction of new risks related to dropped objects and vessel transfers. Not possible to modify vessel to allow additional fuel storage.	**Rejected** – eliminating bunkering via hoses introduces new risks related to dropped objects and vessel transfers. The bunkering method is consistent with industry and maritime practices.
N/A	Require all support vessels involved in the Activity to be double hulled (administration control)	Reduces the likelihood of a loss of hydrocarbon inventory minimising potential environmental impact.	Vessels are subject to availability and must meet Santos' standards during activities; requirement of a double hull on vessels would limit the number available to Santos; also, high cost to require vessels to be refitted with double hulls.	**Rejected** – large costs associated with vessel selection and having an activity schedule determined by vessel availability is considered to be grossly disproportionate compared to the low risk of a vessel collision or large MDO release.
N/A	Reduce the fuel volume on pipelay vessel to reduce the risk of an MDO spill resulting in shoreline accumulation (elimination control)	Reduces the risk of consequences to sacred sites on coastlines. Reduces the potential impacts to culturally significant marine species, including totemic species, such as marine turtles and marine. Supports the maintenance of cultural features and heritage values.	Reducing the fuel capacity will significantly increase the risk to operational reliability (e.g. vessel position loss) and safety (e.g. maintenance of critical emergency fuel reserves to enable the vessel to seek shelter during adverse weather conditions, such as cyclones). In addition, it will also increase the frequency of bunkering activities. Furthermore, the RPS modelling (2021) is based on a worst-case 700 m^3 scenario which is ~20% more fuel than the largest spill scenario volume and does not consider control measures that are in place.	**Rejected** – maintaining critical emergency fuel reserves are required to meet stringent HSE requirements. In addition, reducing the fuel volume of activity vessels will increase the frequency of bunkering activities, thereby increasing the risk associated with increased vessel movements and bunkering activities.

7.6.4 Environmental impact assessment

Receptors	• Physical environment and habitats – water quality; and benthic communities and habitats • Threatened, migratory or local fauna – plankton; invertebrates; marine mammals; marine reptiles; fish (including sharks and rays); and seabirds • Protected areas – marine parks; KEFs; national heritage place; world heritage property; and wetlands of international and national importance • Socioeconomic – commercial, recreational and traditional fisheries; recreation and tourism; and energy industry • Cultural features
Consequence	III – Moderate
The consequence assessment for each receptor category is summarised below. **Water quality**	

It is likely that water quality will be reduced at the location of the release due to hydrocarbon contamination; however, such impacts would be temporary and highly localised due to the rapid weathering of the released MDO in the open offshore location. Stochastic modelling results predict that entrained oil concentrations exceeding 100 ppb (at or above moderate threshold levels) may extend up to 134.5 km from the release location.

Benthic communities and habitats

Benthic communities, such as macrofauna and infauna (e.g. filter feeders, brittle stars, crustaceans, polychaetes and molluscs) and benthic primary producers (e.g. macroalgae, seagrass and corals) are vulnerable to hydrocarbons (surface and entrained).

Modelling predicted that some shallow shoals and banks (e.g. the top of the shoal is within the top 10 m of the water column) may be contacted by entrained hydrocarbons above impact values (100 ppb, 1 hour) at a low probability (1–5%). These include Hancox Shoal, Moresby Shoals, Skottowe Shoal, Marsh Shoal and Foelsche Bank. The maximum concentration predicted is 168 ppm at Foelsche Bank. These banks and shoals are expected to be characterised by sparse to medium-density filter feeders based on surveys of similar inshore banks and shoals. Filter feeders are particularly susceptible as they directly ingest hydrocarbons while feeding; this may cause mortality or sub-lethal impacts such as alteration in respiration rates, decreases in filter-feeding activity and reduced growth rates due to biochemical effects (Keesing and Edgar, 2016). Lethal and sub-lethal effects to filter feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction, leading to changes in community composition and structure (Wei et al., 2012). However, the communities are expected to recover as the hydrocarbon concentration decreases and weathers.

There is the potential for intertidal primary producers such as mangroves, seagrasses and corals to be impacted by spilled hydrocarbons. These are present along much of the coastline. The modelling results predicted that Bathurst Island was the only receptor where potential shoreline contact above impact exposure value (100 g/m^2) during all 3 seasons was predicted, at low probabilities (1–5%), and the minimum time before moderate shoreline accumulation was 5.29 days during winter conditions. The maximum length of Bathurst Island shoreline exposure predicted is up to 6 km. Vernon Islands (3%), Melville Island (1%) and Cox Finniss (1%) were predicted to experience shoreline accumulation during the summer season only. Hence a worst-case spill may only credibly impact a relatively small portion of the coastline, including any associated primary producer habitats.

Mangrove habitat and associated mud flats are widely represented along the Tiwi Islands coastline. Hydrocarbon coating of prop roots of mangroves can occur from surface hydrocarbons when they are deposited on the aerial roots. Hydrocarbons deposited on the aerial roots can block the pores used by the plants to breathe or interfere with the trees' salt balance resulting in sub-lethal and potentially lethal effects. Mangroves can also be impacted by entrained aromatic hydrocarbons that may adhere to sediment particles. In low-energy environments such as mangroves, deposited sediment-bound hydrocarbons are unlikely to be removed naturally by wave action and may be deposited in layers by successive tides (NOAA, 2014). Given the low portion of persistent hydrocarbon in MDO, hydrocarbons in mangrove environments are not expected to persist long-term.

Tidal mudflats, like mangroves, are a low-energy environment and are, therefore, susceptible to potential impacts from persistent surface or stranded hydrocarbons. Hydrocarbons in contaminated sediments can persist for years and significantly impact benthic infauna and their dependent migratory shorebird populations (Duke and Burns, 2003). Saenger (1994) noted that mudflats were the most severely affected habitat 2 years after the Gulf War spill, with no sign of living epibiota. However, the hydrocarbon type in the Gulf was crude oil with a larger fraction of persistent components, compared to MDO. Given the low persistent hydrocarbons in MDO, the persistence of hydrocarbons is expected to be short-term.

Seagrasses in the subtidal and intertidal zones have different degrees of exposure to hydrocarbon spills. Subtidal seagrass is generally considered much less vulnerable to surface hydrocarbon spills than intertidal seagrass, primarily because freshly spilled hydrocarbons float under most circumstances. Dean et al. (1998) found that hydrocarbons mainly affect flowering. Therefore, species that can spread through apical meristem growth (growth at the tips of the root) are not as affected (such as Zostera, Halodule and Halophila species).

Potential impacts may include smothering or coating, although these impacts are more commonly associated with IFO-180/HFO (note: vessels are prohibited from carrying IFO-180/HFO during the Activity).

MDO tends to entrain within the water column, which can lead to seagrass coming into contact with or absorbing the water-soluble fraction. Contact and absorption have the potential to reduce photosynthesis and tolerance to other stress factors (Runcie et al., 2010; Taylor and Rasheed, 2011). Seagrass in the intertidal zone, such as that of the Tiwi Islands, is particularly vulnerable as it may come into direct contact with surface hydrocarbons and entrained components, which can smother and kill seagrasses if it coats their leaves and stems (Taylor and Rasheed, 2011). This conclusion is supported by Howard et al. (1989), who noted that surface hydrocarbon spills that become stranded on the seagrass and smother it during the rise and fall of the tide could result in reduced growth rates, blackened leaves and mortality. Wilson and Ralph (2011) concluded that long-term impacts to seagrass are unlikely unless hydrocarbon is retained within the seagrass meadow for a sustained duration.

The shoreline habitats are expected to recover as the hydrocarbon evaporates (95% within several days) and degrades. Only a portion of the shoreline (6 km based on the worst-case deterministic model run) is predicted to be affected with a low probability (5%) of occurring. Therefore, impacts at the regional benthic community distribution or population level are considered unlikely.

Water soluble hydrocarbon fractions associated with surface slicks also cause high coral mortality (Shigenaka, 2001) via direct physical contact of hydrocarbon droplets with sensitive coral species (such as the branching coral species). Inter-tidal and shallow water corals may be impacted by surface and entrained hydrocarbons. Impacts may include increased mortality and sub-lethal effects such as changes in feeding, bleaching (loss of zooxanthellae), and increased mucous production, resulting in reduced growth rates and impaired reproduction (Negri and Heyward, 2000). The habitat around the Tiwi Islands is restricted to coastal reef areas and inter-tidal platforms. Given the patchy distribution of inter-tidal and shallow water corals

and the non-persistent nature of the hydrocarbon, impacts to corals in the event of an MDO release are expected to be restricted to sub-lethal impacts.

Marine fauna

Plankton

Plankton communities may be impacted by a hydrocarbon release, particularly entrained fractions. Toxic effects from exposure to entrained hydrocarbons may cause impacts such as blocked filter feeding organs and impacts resulting from ingesting hydrocarbons. Modelling of the credible release scenario predicts that entrained hydrocarbons above impact thresholds are expected to be highly localised around the release location. Given the high productivity of planktonic communities and the nature and scale of the credible release, these impacts are expected to be temporary and highly localised to the release location.

Pelagic and demersal fish communities (including sharks and rays)

Fish mortalities are rarely observed to occur as a result of hydrocarbon releases (ITOPF, 2011). This has generally been attributed to the possibility that pelagic fish can detect and avoid surface waters underneath hydrocarbon releases by swimming into deeper water or away from the affected areas. Fish that have been exposed to dissolved aromatic hydrocarbons are capable of eliminating the toxicants once in clean water, thus individuals exposed to a release are likely to recover (King et al., 1996). Where fish mortalities have been recorded, the releases (resulting from the groundings of the *Amoco Cadiz* [1978] and *Florida* [1969] tankers, which were significantly bigger than the worst-case credible release scenario considered in this EP) occurred in sheltered bays, which limited the ability of fish to access clean water and eliminate toxicants. Given the nature and scale of the credible release scenario and the open-ocean environment of the credible release location, impacts to pelagic and demersal fish are expected to be highly localised and temporary.

Marine mammals

The MEVA intersects a breeding BIA for the Indo-Pacific humpback dolphin near Darwin Harbour. Although no migration routes exist within the MEVA, marine mammals are highly mobile and known to transit through the region. Studies and field observations suggest that marine mammals may be able to detect and avoid hydrocarbon slicks (Geraci and St Aubin, 1988). Marine mammals are vulnerable to the effects of surface hydrocarbons because they must surface to breathe. Direct contact with surface slicks and inhalation of vapours may irritate eyes, airways and lungs. Lethal or sublethal effects will depend on the concentration of the hydrocarbons and the length of exposure. In addition, heavily oiled areas can reduce reproductive rates, as monitored during the Barataria Bay bottlenose dolphins after the Macondo oil spill in 2010 (Lane et al., 2015).

Approximately 40% of the MDO is predicted to evaporate within 24 hours, with 75% evaporated over several days, depending on the prevailing conditions limiting the persistence on the sea surface. Because spilt MDO is expected to disperse and weather rapidly, the potential for impacts to marine mammals will be concentrated around the release location and limited to individuals. No population-level impacts are expected.

Marine reptiles

Internesting BIAs and habitat critical to the survival of flatback and olive ridley turtles and foraging BIAs for the green and olive ridley turtles intersect the MEVA. A hydrocarbon spill above impact thresholds in these areas may impact biologically important behaviours. Turtle nesting in the region occurs year-round, peaking from April to September. A spill during these months may impact a portion of the population. However, the protracted nature of the breeding season means that a spill will not credibly impact a large portion of the population. Approximately 260 km of sandy beaches surround the Tiwi Islands, many of which are documented to host turtle nesting. It is important to acknowledge that turtles have a strong affinity for specific nesting beaches and are unlikely to relocate to an alternative beach if their preferred nesting site is affected by hydrocarbons. Deterministic modelling predicts that the longest length of oiled shoreline at the moderate exposure threshold was 6 km with a low probability (5%) of occurring. At the end of this modelling simulation (50 days), only 1% of the total MDO volume remained ashore. No high (>1,000 g/m^2) shoreline exposure was predicted during the model simulation. Therefore, even considering the longest length of oiled shoreline predicted by the model, it will not have a significant impact on the nesting turtle population, and the duration of the impact will be limited.

Turtle nests are also typically located above the high water mark, typically the highest point along the shoreline that stranded oil will reach. Direct contact between turtle eggs and the stranded hydrocarbons is very unlikely. Nesting females and hatchlings emerging from nests may be exposed to stranded hydrocarbons when moving on nesting beaches, potentially resulting in contamination. Exposure may result in light oiling of nesting females and hatchlings, subsequently leading to sub-lethal effects such as skin irritation; no mortality is expected. Given the non-persistent nature of MDO and low levels of hydrocarbons potentially stranding on shorelines, the potential for impacts to nesting turtles, egg clutches and hatchlings on beaches is considered low.

Marine turtles are susceptible to the effects of hydrocarbon spills during all life stages (NOAA, 2010). They are frequently in contact with the sea surface and show little avoidance behaviour in response to the presence of surface hydrocarbons, which makes them vulnerable to coating and inhalation of toxic vapours. Contact with surface slicks or entrained hydrocarbon can therefore result in hydrocarbon adherence to body surfaces (Gagnon and Rawson, 2010), causing irritation of mucous membranes in the nose, throat and eyes and leading to inflammation and infection (NOAA, 2010). Oiling can also irritate and injure skin, most evident on vulnerable areas such as the neck and flippers (Lutcavage et al., 1995). Given the non-persistent nature of the hydrocarbons and the expected rapid weathering of surface hydrocarbons in the tropical environment, the timeframe during which turtles may be exposed to hydrocarbons above impact thresholds is of a short duration. The spatial extent of the MEVA, and the wide distribution of turtle species in the region, indicates that population-scale impacts are considered unlikely.

No EPBC Act listed threatened sea snakes are known to be present within the MEVA; however, low numbers of EPBC Act listed marine sea snake species may occur around shallow banks and shoals. In addition, crocodiles may also transit the MEVA. Sea snakes and crocodiles may be vulnerable to hydrocarbon spills due to their need to surface to breathe and may

spend time at the sea surface to bask in the sun. However, little information is available to describe the effects of hydrocarbon spills on sea snakes and crocodiles.

Seabirds and migratory shorebirds

The Wildlife Conservation Plan for Seabirds (CoA, 2020) identified pollution as a threat to seabirds and their habitats. As outlined in the Wildlife Conservation Plan for Seabirds (CoA, 2020), one of the objectives is to enhance contingency plans to prevent and respond to environmental emergencies that impact seabirds and their habitats, which is adopted in the C7.6.2 (refer to Table 7-12).

Seabirds and migratory shorebirds are particularly vulnerable to contact with surface hydrocarbons. Physical contact of seabirds with surface slicks is by several exposure pathways, primarily immersion, ingestion and inhalation. Contact with hydrocarbons may result in plumage fouling and hypothermia (loss of thermoregulation) (Hassan and Javed, 2011), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia, and irritation of eyes, skin, nasal cavities and mouths (AMSA, 2015; ITOPF, 2011) and result in mortality due to oiling of feathers or hydrocarbon ingestion. Longer-term exposure effects that may potentially impact seabird populations include a loss of reproductive success (loss of breeding adults) and malformation of eggs or chicks (AMSA, 2015).

A hydrocarbon spill may result in surface slicks above impact thresholds in foraging habitats for seabirds. Typically, seabird distributions are concentrated around islands—hydrocarbons in and near nesting/roosting areas may increase the number of seabirds impacted. The MEVA does not intersect any bird BIA (including nesting/roosting areas). The closest bird BIA is the crested tern BIA around Seagull Island (outside of the EMBA), which is near the Tiwi Islands (approximately 90 km north of the OA). Given the nature and scale of the credible hydrocarbon release, the potential for impacts to birds is expected to be temporary (hours to days). Stranded hydrocarbons may come into contact with wading shorebirds, potentially resulting in oiling. Given the relatively low likelihood of shoreline accumulation above the moderate impact threshold, contact of this nature is considered very unlikely to occur. As seabirds nest above the high water mark, direct contact to nests, eggs or hatchlings by stranded hydrocarbons is not expected to occur.

Protected Areas

National Heritage Place and World Heritage Property

Modelling predicted no potential for surface oil or dissolved hydrocarbon exposure to any national heritage place or world heritage property. In addition, the modelling also predicted no shoreline accumulation at impact exposure values (100 g/m^2). Stochastic modelling predicted a very low probability (2%) of shoreline accumulation at low exposure values (10 g/m^2) to Kakadu National Park (national heritage place, world heritage property, wetlands of international and national importance). The minimum time before exposure is over 30 days with a maximum volume of 2.3 m^3. Therefore, it is considered very unlikely that any visual amenity or negative socioeconomic impact may potentially occur.

Similarly, the modelling predicts no moderate exposure thresholds for any hydrocarbon phase to Finniss Floodplain and Fog Bay Systems (wetlands of national importance). Finniss Floodplain and Fog Bay System forms part of the approximately 200 km Cox-Finniss shoreline receptor. During the summer season, Cox-Finniss shoreline receptor predicted a 14% probability that shoreline accumulation may occur at low exposure thresholds after approximately 7 days, potentially impacting up 19 km of the 200 km (<10%) with a peak volume of less than 9 m^3. Therefore, it is unlikely that there will be any visual amenity or negative socioeconomic impact within the smaller area of the Finniss Floodplain and Fog Bay Systems.

Marine Parks

As outlined above, a hydrocarbon spill has the potential to impact water quality and a range of biological receptors. These environmental values are contained within the Oceanic Shoals Marine Park. Impacts to environmental values within these protected areas may diminish the Oceanic Shoals Marine Park's value. However, given the nature and scale of the credible spill scenario, such impacts are considered unlikely. Modelling predicted no potential for surface oil or dissolved hydrocarbon exposure and a 3% probability of entrained hydrocarbons (above thresholds) at the Oceanic Shoals Marine Park.

KEFs

The open waters above the seabed KEF, Carbonate bank and terrace system of the Van Diemen Rise overlap the MEVA. Impacts to this seabed KEF and the values of the KEF are considered to be negligible, given their location on the seabed and the surface nature of the releases in which the concentration of the entrained hydrocarbons is highest in the upper water column (RPS, 2019).

Socioeconomic (fisheries, tourism, recreation, and other third-party operators)

There is the potential for hydrocarbons to temporarily disrupt fishing activities (traditional, recreational and commercial), and tourism and recreation activities if the surface, shoreline or entrained hydrocarbon moves through frequented areas.

However, the high rate of evaporation means that little MDO will become entrained and few aromatic hydrocarbons are predicted to become dissolved. Given the volume of MDO that could potentially be released, it is unlikely that impacts could be detected to fisheries on a stock level although it is more likely that natural variation in fish abundance would be on a greater scale than any impacts attributable to a hydrocarbon spill. A hydrocarbon release may also temporarily displace activities such as fishing, tourism and recreation from within sections of the MEVA. This displacement would be localised and short-term (days). A hydrocarbon release may result in tainting of fished species. This could potentially result in commercial fishers being unable to sell their catch, which may result in a loss of income or other fishers unable to eat their catch. Spilt hydrocarbons may also contaminate fishing gear, which may require cleaning.

Shoreline and nearshore tourism and recreational activities could also be affected by reducing the water quality and aesthetic appeal, however this is likely to be limited to a short duration.

A MDO spill could also disrupt other energy industry operations in the region (e.g. support vessels transiting to/from Darwin), military exercises and commercial shipping from within sections of the MEVA. This displacement can reasonably be expected to be localised and short-term (days).

On the basis of the above assessment, an MDO release has the potential to impact an array of environmental and socioeconomic receptors, with the highest consequence considered to be III – Moderate. **Cultural features** In the event of an unplanned MDO release during the wet season, shoreline oil accumulation was predicted to occur with receptors from the NT mainland (South Alligator, Litchfield and Cox-Finnis) and NT islands (e.g. Tiwi Islands and Vernon Islands) at low thresholds above 10% probability. During the transitional season, shoreline oil accumulation was predicted with Vernon Islands and no shoreline contact was predicted during the dry season at low thresholds above 10% probability. These shorelines have possible associations with cultural values (e.g. ILUAs; sacred sites [registered, recorded, or not]; marine parks and sea country). Potential impacts to cultural features from a hydrocarbon spill may also include a decline in traditional food sources or mortality of fauna with cultural significance. Modelling predicted no potential for surface oil or shoreline contact with the Croker Island native title determination. Modelling predicted shoreline contact with the Larrakia native title determination at low thresholds at a low probability (6%) and a peak of 5 m^3 on the shoreline. Low thresholds equate to approximately 2 teaspoons of oil per m^2 of shoreline. Note that the RPS modelling was based on a larger maximum fuel tank volume than that of any activity vessel and does not take into account any mitigation and management controls, including oil spill response. Santos will notify relevant FNCCs and clan groups, in the event that a MDO release has the potential to impact their coastal areas. Table 8-5 and Section 7.1 of OPEP (BAS-210 0131) outline the spill notification requirements to FNCCs and clan groups.	
Likelihood	B – Unlikely
A worst-case MDO release resulting from a vessel collision is unlikely to have widespread ecological effects given the nature of the hydrocarbons on board, the finite volumes that could be released, control measures in place, the water depth and the transient nature of marine fauna in this area. Long-term impacts resulting in complete habitat loss or degradation are not considered likely given the control measures proposed to prevent releases; therefore, the Activity will be conducted in a manner that is considered acceptable. The likelihood of an MDO release occurring due to vessel collision or refuelling is limited given the set of mitigation and management controls in place. Consequently, the likelihood of a vessel collision releasing hydrocarbons to the environment, is considered to be unlikely.	
Residual Risk	The residual risk is considered Low.

7.6.5 Demonstration of as low as reasonably practicable

Using vessels is integral to the Activity, and therefore the associated risk of unplanned hydrocarbon releases cannot be completely eliminated.

All reasonably practicable control measures were reviewed, and those adopted are considered appropriate to manage the residual risk to a Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

In terms of spill response activities, Santos will implement oil spill response as specified within the OPEP (BAS-210 0131). The OPEP includes a detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures.

7.6.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked as Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the EMBA identifies habitat degradation / modification, pollution or oil spills as a threat (Table 3-14): **Conservation Advice:** • Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (TSSC, 2015e) • Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC, 2014a) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014)

	• Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015f) • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009) • Approved Conservation Advice for *Pristis pristis* (Largetooth Sawfish) (TSSC, 2014b) • Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (TSSC, 2013) • National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (DCCEEW, 2022a) • Conservation Advice *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Conservation Advice *Charadrius leschenaultii* (Greater sand plover) (TSSC, 2016) • Conservation Advice *Charadrius mongolus* (Lesser Sand Plover, Mongolian Plover) (TSSC, 2016d) • Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024a) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b) • Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b) • Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) • Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g) • Conservation Advice for *Tringa nebularia* (common greenshank) (DCCEEW, 2024h) • Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice *Limosa lapponica baueri* (Bar-tailed godwit [western Alaska]) (TSSC, 2016a) **Recovery Plans:** • Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) • Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) • Wildlife Conservation Plan for Seabirds (CoA, 2020). Recovery plans / conservation advice for other species that may occur in the MEVA do not identify pollution or habitat degradation / modification as a key threat or have explicit relevant objectives or management actions. AMP zoning principles and objectives were also considered for the Marine Bioregional Plan for the North Marine Region (CoA, 2012a). The Activity is not inconsistent with these objectives. The objectives of these publications were considered during impact and risk assessments. The controls outlined in Table 7-12 are consistent with the objectives of the material listed above. Santos considers the impacts of hydrocarbon release from vessel collision to be not inconsistent with these objectives.

Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – management measures are consistent with Commonwealth Acts and Marine Orders: *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) and *Navigation Act 2012* (Cth), Marine Order 30: Prevention of Collisions and Marine Order 21: Safety of Navigation and Emergency Procedures. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant Person feedback received for this EP and other Barossa Gas Project EPs has been considered and where applicable, additional EPOs, CMs and EPSs (e.g. EPO-14, C6.2.10 and C6.2.10.1) were adopted. Santos will notify all Relevant Persons who have requested notification in the event of a spill. As a result, Table 8-2 and the OPEP have also been updated to reflect additional requests for notifications in the event of a spill. Santos has adopted control measure (C6.2.10) which was informed by Dr Corrigan's recommendations and the suggestions of a number of senior and authoritative Tiwi Islanders about culturally appropriate responses.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The potential impacts and risks from vessel collision resulting in hydrocarbon (MDO) releases are well understood, and the activities will be managed in accordance with relevant legislation and standards. With the implementation of industry standards, Relevant Persons initiated and activity-specific control measures to reduce the likelihood of a vessel collision (and minimise impacts), the residual risk is assessed to be low and ALARP. Relevant Persons' concerns have been addressed regarding this hazard. Therefore, it is considered that the proposed control measures will reduce the risk of impact from an MDO release to a level that is acceptable.

7.7 Contingency spill response operations

The spill response strategies that may be adopted in the event of a hydrocarbon spill from this activity have been identified in the OPEP (BAS-210 0131). An environmental assessment of these spill response strategies was conducted, as detailed below.

An environmental assessment of the hydrocarbon spill scenarios considered for this activity and relevant to spill response operations is provided in Section 7.6.

7.7.1 Description of event

Event	In the event of a hydrocarbon spill, response strategies will be implemented to reduce environmental impacts to ALARP. The selection of strategies will be undertaken using NEBA. Spill response will be under the direction of the relevant control agency, as defined in the OPEP (BAS-210 0131), which may be Santos, another agency or both. In all instances, Santos will undertake a 'first-strike' spill response and will act as the control agency until the designated control agency assumes control. The response strategies and applicable response planning thresholds considered to be appropriate for the worst-case spill scenarios identified for the Activity and detailed in the OPEP (BAS-210 0131) and comprise: • source control • monitor and evaluate • mechanical dispersion • oiled wildlife response • scientific monitoring • waste management. Response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, but poorly planned and coordinated response activities can result in a lack of, or inadequate, information being available, upon which poor decisions can be made, exacerbating or causing further environmental harm. An inadequate level of training and guidance when implementing spill response strategies can also result in environmental harm beyond that caused by the spill.
Extent	Extent of spill. Spill response could occur anywhere within the EMBA for the worst-case spill scenarios, as per response planning thresholds (Refer to Section 6.2 of the OPEP (BAS-210 0131).
Duration	The total duration of the spill response effort will exceed the duration of the worst-case spill—persistence of the oil in the environment and the requirement to remove this oil and/or monitor impacts and recovery to sensitive receptors adds to the time. The OPEP (BAS-210 0131) further details the likely duration of specific response strategies.

7.7.2 Nature and scale of environmental impacts

Noise emissions	
Spill response operations will involve aircraft and vessels, which will generate noise both offshore and in nearshore locations within the EMBA.	
Potential receptors	• Threatened, migratory or local fauna • Protected areas • Socioeconomic receptors
Underwater noise from vessels may potentially impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals. Section 6.3 details potential noise emission impacts from vessels and helicopters. Cetaceans and turtles have been identified as the key concern for vessel noise. There is a known dolphin breeding BIA and internesting BIAs and habitat critical to the survival of flatback and olive ridley turtles and foraging BIAs for the green and olive ridley turtles intersecting the MEVA. Vessels may also need to enter marine parks and other areas used for tourism, commercial and recreational fishing, and traditional purposes.	
Light emissions	
Spill response operations will involve vessels which are required, at a minimum, to display navigational lighting. Vessels may operate near shoreline areas during spill response operations. Spill response activities may also involve onshore operations including vehicle use and temporary camps, both of which may require lighting.	

Potential receptors	• Threatened, migratory or local fauna • Protected areas • Socioeconomic receptors

Lighting may cause behavioural changes to fish, mammals, birds and marine turtles that can have a heightened consequence during key life cycle activities, such as turtle nesting and hatching. Turtles and birds, which includes threatened and migratory fauna (Table 3-12), have been identified as key fauna susceptible to lighting impacts. Section 6.4 further details the nature and scale of light emission impacts. Lighting can cause disorientation in flying birds, disrupting resting and breeding behaviours.

Turtle BIAs for internesting and foraging are located in the Joseph Bonaparte Gulf and Tiwi Islands surrounds. There is also habitat critical to the survival of olive ridley and flatback turtles within the MEVA. During nesting and hatching seasons, lighting may cause behavioural impacts to turtles including aborted nesting attempts and misorientation of newly hatched turtles, which may increase mortality rates. Because of impacts to fauna, lighting has the potential to impact supported industries such as tourism and indirect impacts on the values of protected areas.

Atmospheric emissions

Using fuels to power vessel engines, generators and mobile equipment during spill response operations will result in emissions of GHGs, such as CO_2, CH_4 and N_2O, along with non-GHGs such as SO_x and NO_x. Emissions will result in a localised decrease in air quality.

Potential receptors	• Threatened, migratory or local fauna • Physical environment or habitat (air quality) • Socioeconomic receptors

Atmospheric emissions from spill response equipment will be localised, and using mobile equipment, vessels and vehicles is not considered to create emissions on a scale where noticeable impacts would be predicted. Emissions may occur in protected areas; however, the scale of the impact relative to potential oil spill impacts is considered negligible.

Operational discharges and waste

Operational discharges include routine discharges from vessels used during spill response, such as:

- deck drainage
- putrescible waste and sewage
- cooling water from operating engines
- bilge water
- ballast water
- brine discharge.

Other specific spill response discharges and waste creation may occur, including:

- cleaning of oily equipment, vessels and vehicles
- sewage and putrescible and municipal waste at offshore staging sites
- creation, storage, transport and disposal of oily waste and contaminated organics.

Potential receptors	• Threatened, migratory or local fauna • Physical environment or habitat • Protected areas • Socioeconomic receptors

Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, and temperature and salinity increases, as detailed in Section 6.6. Discharge could potentially occur adjacent to marine communities, such as corals, seagrass and macroalgae, and in protected areas (i.e. receptors anywhere within the EMBA), which support a more diverse faunal community; however, discharges are still expected to be localised and temporary.

Cleaning of oil-contaminated equipment, vehicles and vessels has the potential to spread oil from contaminated areas to areas not impacted by a spill, potentially spreading the impact area and moving oil into a more sensitive environment.

Sewage and putrescible and non-putrescible waste will be generated from offshore activities at temporary staging/mooring areas, which may include toilet and washing facilities. These wastes have the potential to impact water quality, impact habitats, and reduce the aesthetic value of the environment, which may be within protected areas.

Physical presence and disturbance

Moving and operating vessels during spill response operations has the potential to disturb the physical environment and marine habitats and fauna (e.g. vessel strike, behavioural changes), which may occur within protected areas. Disturbance may also impact socioeconomic values of an area. Vessel movement could potentially introduce IMS (attached as biofouling) to nearshore areas, while vehicle and equipment movement could spread non-indigenous flora and fauna.

Oiled wildlife response activities may also involve deliberately disturbing (hazing), capturing, handling, cleaning, rehabilitating, transporting and releasing wildlife, which could lead to additional impacts to wildlife.

Potential receptors	• Threatened, migratory and local fauna • Physical environment or habitat • Protected areas • Socioeconomic receptors
Vessel use may disturb benthic communities, including corals, seagrass and macroalgae. Impacts to habitats and communities from vessels include damage through deploying anchors and mooring lines, and from grounding. Vessel use in shallow coastal waters also increases the chance of contact with, or physical disturbance of, marine fauna such as turtles and dugongs. Booms create a physical barrier on the water surface that has the potential to injure or entangle passing surface-breathing or -feeding marine fauna. Oiled wildlife response may include hazing, capturing, handling, cleaning, rehabilitating, transporting, cleaning and releasing wildlife susceptible to oiling, such as birds and marine turtles. Although oiled wildlife response is aimed at having a net benefit, poor responses can potentially create additional stress and exacerbate impacts from oiling, interfere with life cycle processes, hamper recovery and, in the worst instance, increase levels of mortality. Impacts from IMS are described in Section 7.2 and are not described further in this section. Disturbance to marine habitat, and the potential for disrupting culturally sensitive areas, may occur within protected areas (e.g. AMPs).	
Disruption to other users of marine and coastal areas and townships	
Spill response operations may involve using vessels and equipment in areas used by the general public or industry in Australia and potentially Indonesia. Mobilising spill response personnel into forward operating bases may also place increased demands on local accommodation and other businesses.	
Potential receptors	• Socioeconomic receptors • Cultural features
Using vessels in the offshore and nearshore environment and undertaking spill response operations may exclude the general public, cultural uses (e.g. access to cultural food resources and capability to care for sea country), commercial industries (e.g. fishing, tourism, energy), or come within proximity to known sacred sites (for example on Tiwi Islands). As well as limiting access, this may potentially impact revenue with respect to commercial businesses. Mobilising personnel to regional communities has the potential to affect the local community through demands on local accommodation and business, reducing the availability of services to members of the public.	

7.7.3 Environmental performance outcomes and control measures

An assessment of the environmental benefits and the potential costs or issues associated with control measures relevant to response vessels and helicopters for this Activity are described in Table 7-13 to demonstrate that the potential impacts from this aspect are ALARP. Additional control measures that are more specific to spill response are presented in the OPEP (BAS-210 0131).

Control measures that are adopted have associated EPSs and measurement criteria, which are presented in the relevant strategy sections of the OPEP (BAS-210 0131).

Table 7-13: Control measures evaluation for spill response operations

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
C6.3.1	Avoid activities near cetaceans and turtles. (isolation control) where vessel crew act as wildlife observers	see Table 7-4	see Table 7-4	**Adopted** – see Table 7-4
C6.7.1	Apply a chemical selection procedure for all chemicals planned to be discharged (administrative control)	see Table 6-24	see Table 6-24	**Adopted** – see Table 6-24
C6.1.1	Activity vessels equipped and crewed in accordance with Australian maritime requirements (administrative control)	see Table 6-2	see Table 6-2	**Adopted** – see Table 6-2
C6.5.1	Atmospheric (GHG and non-GHG) emissions from combustion managed in accordance with standard	see Table 6-17	see Table 6-17	**Adopted** – see Table 6-17

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
	maritime practice. (administrative control)			
C6.6.2	Routine discharges of treated sewage and grey water, in accordance with the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 96 (Marine Pollution Prevention – Sewage) (administrative control)	see Table 6-18	see Table 6-18	**Adopted** – see Table 6-18
C6.1.2	Undertake stakeholder engagement (after an accidental spill event), including applicable notifications (administrative control)	Promotes awareness and reduces potential impacts from response to socioeconomic activities.	Minimal cost in relation to overall effort/costs in managing incident.	**Adopted** – considered a standard control for incident management.

7.7.4 Environmental impact assessment

Receptor	Consequence level
Spill response operations – noise emissions	
• Threatened, migratory or local fauna • Protected areas • Socioeconomic receptors	The receptors considered most sensitive to vessel noise are marine turtles, whale sharks, dolphins and whales. However, by adopting control measures to limit close interaction with protected fauna (i.e. Protected Marine Fauna Interaction and Sighting Procedure [EA-91-II-00003]), only temporary behavioural disturbance is expected, with a consequence of I – Negligible.
Consequence	I – Negligible
Likelihood	B – Unlikely
Residual Risk	Very Low
Spill response operations – light emissions	
• Threatened, migratory or local fauna • Protected areas • Socioeconomic receptors	The receptors considered most sensitive to lighting from vessel operations are seabirds, shorebirds and marine turtles. Because there are restrictions on night-time operations by spill response vessels, which will demobilise to mooring areas offshore with safety lighting only, impacts from vessels are considered to be I – Negligible.
Consequence	I – Negligible
Likelihood	B – Unlikely
Residual Risk	Very Low
Spill response operations – atmospheric emissions	
• Threatened, migratory or local fauna • Physical environment or habitat • Socioeconomic receptors	Atmospheric emissions from spill response equipment will be localised and impacts to even the most sensitive fauna, such as birds, are expected to be Negligible. Because of the localised and low level of emissions, impacts to protected area values, physical environment and socioeconomic receptors are predicted to be I – Negligible.
Consequence	I – Negligible
Likelihood	B – Unlikely
Residual Risk	Very Low

Receptor	Consequence level
Spill response operations – operational discharges and waste	
• Threatened, migratory or local fauna • Physical environment or habitat • Socioeconomic receptors	Activity discharges from vessels may create a localised and temporary reduction in marine water quality, which has the potential to impact shallow marine habitats in particular. However, by adopting regulatory requirements for vessel discharges, which prevent discharges close to shorelines, discharges will have a negligible potential to impact to habitats, fauna or protected area values. Washing vessels and equipment will take place only in defined offshore hot zones thus preventing impacts to shallow habitats. Sewage, putrescible waste and municipal waste generated onshore will be stored and disposed of at approved locations. Storing, transporting and disposing of hydrocarbon-contaminated waste arising from spill response operation actions will be managed by Santos' appointed waste management contractor, and dedicated waste containment areas will prevent hydrocarbon contamination spreading or leaching. Operational discharges from spill response operations are expected to be II – Minor.
Consequence	II – Minor
Likelihood	B – Unlikely
Residual Risk	Very Low
Spill response operations – physical presence and disturbance	
• Threatened, migratory or local fauna • Physical environment or habitat • Protected areas • Socioeconomic receptors	Using vessels has the potential to disturb benthic habitats, including sensitive shoal habitats such as corals and macroalgae, and seagrass meadows. A review of shallow water habitats, and of bathymetry, and establishing demarcated areas for access and anchoring will reduce the level of impact to I – Negligible. These habitats or environments are likely to contain values of the protected area they occur in, and therefore the impact to the protected areas from physical disturbance is considered II – Minor. The main direct disturbance to fauna would be hazing, capturing, handling, transporting, cleaning and releasing the wildlife susceptible to oiling impacts, such as birds and marine turtles. This would only be done if this intervention were to deliver a net benefit to the species, but it may result in a Minor consequence following compliance with Santos' Wildlife Framework Plan (SO-91-BI-20014) and the NT Oil Spill Contingency Plan (DOTMS, 2014). This impact is considered II – Minor.
Consequence	II – Minor
Likelihood	B – Unlikely
Residual Risk	Very Low
Spill response operations – disruption to other users of marine and coastal areas and townships	
• Socioeconomic receptors • Cultural features	Using vessels in the offshore environment and for spill response activities may exclude the general public, cultural uses (e.g. access to cultural food resources and capability to care for sea country) and commercial industries (e.g. fishing, tourism), or come within proximity to known sacred sites (for example on Tiwi Islands). It should be noted that vessel based response activities will be limited to areas where oil is present at high thresholds, and response activities outside of this area would include less obtrusive measures such as monitoring and surveillance and scientific monitoring. Note: This is distinct from the socioeconomic impact of a spill itself. With control measures applied, it is considered that the additional impact of spill response activities on affected industries would be II – Minor.
Consequence	II – Minor
Likelihood	B – Unlikely
Residual Risk	Very Low

The spill response activities could be within an area that may overlap with cultural features. These cultural features (refer to Section 3.2.14) will be considered through the NEBA process described in the OPEP (BAS-210 0131).

7.7.5 Demonstration of as low as reasonably practicable

A NEBA is the primary tool used during spill response to evaluate response strategies—the goal is to select strategies that result in the least net impact to key environmental sensitivities. The NEBA process will identify and compare net environmental benefits of alternative spill response options. Effectively, the NEBA will determine

whether an environmental benefit will be achieved by implementing a response strategy or by undertaking no response. The NEBA will be undertaken by the relevant controlling agency for the Activity. For those activities under the control of Santos, the Incident Management Team (IMT) Environmental Team Leader will be responsible for reviewing the priority receptors and selected response strategies identified in this EP and coordinating the NEBA for each operational period. This will demonstrate that, at the strategy level, the response operations reduce additional environmental impacts to ALARP.

Spill response activities will be conducted in offshore and nearshore waters using vessels and aircraft. The greatest potential for additional impacts from implementing spill response is considered to be on wildlife from oiled wildlife response activities.

Santos, together with the controlling agency for spill response, will apply appropriate processes and standards to ensure spill response impacts are reduced to a level that is ALARP.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the impacts such that the residual risk is assessed to be Very Low. The proposed control measures are in accordance with Santos' risk management criteria and are considered appropriate to reduce impacts to ALARP.

7.7.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – the highest ranking residual risk is Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – The following material published in relation to threatened and migratory species within the EMBA identifies habitat degradation / modification, pollution or oil spills as a threat (Table 3-14): **Conservation Advice:** • Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (TSSC, 2015e) • Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (DEWHA, 2008b) • Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC, 2014a) • Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (DoE, 2014) • Approved Conservation Advice for Green Sawfish (DEWHA, 2008a) • Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015f) • Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009) • Approved Conservation Advice for *Pristis pristis* (Largetooth Sawfish) (TSSC, 2014b) • Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (TSSC, 2013) • National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (DCCEEW, 2022a) • Conservation Advice *Calidris tenuirostris* (great knot) (DCCEEW, 2024d) • Conservation Advice *Charadrius leschenaultii* (Greater sand plover) (TSSC, 2016) • Conservation Advice *Charadrius mongolus* (Lesser Sand Plover, Mongolian Plover) (TSSC, 2016d) • Conservation Advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW, 2024a) • Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015b) • Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015c) • Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b)

	• Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW, 2024b) • Conservation Advice for *Calidris canutus* (red knot) (DCCEEW, 2024c) • Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW, 2024f) • Conservation Advice for *Limosa limosa* (black-tailed godwit) (DCCEEW, 2024e) • Conservation Advice for *Pluvialis squatarola* (grey plover) (DCCEEW, 2024g) • Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015g) • Conservation Advice for *Tringa nebularia* (common greenshank) (DCCEEW, 2024h) • Conservation Advice for *Xenus cinereus* (terek sandpiper) (DCCEEW, 2024i) • Conservation Advice *Limosa lapponica baueri* (Bar-tailed godwit [western Alaska]) (TSSC, 2016a) **Recovery Plans:** • Sawfish and River Sharks Multispecies Recovery Plan (CoA, 2015b) • Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a) • Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013) • Conservation Management Plan for the Blue Whale 2015–2025 (CoA, 2015a) • Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) • Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015c) • Wildlife Conservation Plan for Seabirds (CoA, 2020). Recovery plans / conservation advice for other species that may occur in the EMBA do not identify pollution or habitat degradation / modification as a key threat or have explicit relevant objectives or management actions. AMP zoning principles and objectives were also considered for Marine Bioregional Plan for the North Marine Region (CoA, 2012a) and Marine Bioregional Plan for the North-West Marine Region (CoA, 2012b) such as conservation values of the identified protection priorities (Section 3.2.11.2), including the Joseph Bonaparte AMP and Oceanic Shoals AMP. Management is consistent with the zoning of the AMPs, in that risks have been reduced to ALARP, e.g. implementing spill response activities will limit impacts, thus conserving the marine park values (described in Section 1.6 and Table 3-10). The activity is consistent with these objectives. The objectives of these publications were considered during impact and risk assessments. The Activity and controls outlined in Table 7-13 are not inconsistent with the objectives of the material listed above.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – spill response management is consistent with the National Plan for Maritime Environmental Emergencies (AMSA, 2020), and other legislation identified in Sections 6 and 7. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – During any spill response, a close working relationship with relevant regulatory bodies (e.g. AMSA, DEPWS, NT Department of Transport Marine Safety [DOTMS]) will occur; thus, there will be ongoing, coordinated engagement with Relevant Persons on the acceptability of response operations. Relevant Persons listed in Table 4-7, whose functions, interests or activities are considered at risk due to the event, will be included in the list of

	stakeholders who will be notified under Santos' incident management process during the response operations. Wildlife response will be conducted in accordance with Santos' Wildlife Framework Plan (SO-91-BI-20014), the NT Oil Spill Contingency Plan (DOTMS, 2014), and any future NT oiled wildlife response plans developed. Subject to the availability and the participation of the Tiwi Islands Ranger Groups, Santos will continue to undertake training with the Tiwi Islands Ranger Groups prior to the Activity and provide additional on the job training post-spill to additional personnel (if required).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

The implementation of spill response activities to reduce the potential impacts from a spill are required by legislation. The spill response options selected have been demonstrated to show a net environmental benefit, are standard industry practice and are consistent with relevant standards and guidelines, including the National Plan for Maritime Environmental Emergencies (AMSA, 2020). No concerns from Relevant Persons have been raised regarding response activities and the controls proposed reduce the consequences of the potential impacts to minor and ALARP. The controls used during spill response activities are considered to reduce additional impacts and risks to an acceptable level.

7.8 Unplanned release: dry natural gas

7.8.1 Description of event

Event	The PLET foundation will be installed adjacent to the existing Bayu-Undan pipeline with a separation of at least 100 m. Activities will include lifting the PLET foundation and landing the PLET/DPD assembly onto the pre-installed PLET foundation. Santos has identified a rupture of the Bayu-Undan pipeline may be caused by damage to the pipeline during the lifting of the PLET foundation due to impact/drag or dropped object. A pipeline rupture will result in a release of dry gas to the environment. The scale of the Bayu-Undan pipeline leak is dependent on the nature of the rupture. Small 'pinhole' leaks will result in a stream of bubbles which may dissolve before reaching the surface. A major rupture (e.g. catastrophic failure) has the potential to release a volume 151,000 m³ of dry gas forming a large plume in the water column and dispersing into the atmosphere. A catastrophic failure is considered to be the worst-case credible release from the Bayu-Undan Pipeline. As the Bayu-Undan pipeline transports dry natural gas with no liquid phase hydrocarbons, a loss of containment would not release any liquid phase hydrocarbons to the environment. Given that the contents of the pipeline consist entirely of dehydrated gas, condensation of gas phase components upon release is not expected due to the pressure and temperature differential between the pipeline contents and the receiving environment.
Extent	The dry natural gas within the Bayu-Undan pipeline is contained at a relatively high pressure of up to 180 barg. The extent of a leak from the Bayu-Undan pipeline would depend on the nature of the rupture and expected to be limited to within hundreds of metres of the rupture location. Small 'pinhole' leaks may result in a stream of bubbles that could dissolve before reaching the surface.
Duration	Potentially harmful concentrations are limited to a very short period (days) immediately following the release.

Dry natural gas

The Bayu-Undan pipeline consists of dry natural gas that is predominantly methane (~79%), carbon dioxide (6%), hydrogen sulphide (0.004%) and 10% volatile organic compounds (Santos, 2022). However, the gas composition can vary. Physical properties indicate that dry natural gas is highly flammable and will volatilise from the aquatic environment rapidly. It is noted that in practice, acute and chronic effects would not typically be observed (Shell, 2019).

7.8.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water and air quality); threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds); socioeconomic (other marine users); and cultural features.

7.8.2.1 Physical environment

The seabed near the existing Bayu-Undan pipeline adjacent to the proposed PLET foundation location (refer to Table 2-2 for coordinates) is characterised as featureless silty, shelly sand (Figure 3-6), with very sparse (<1%) epibiota (mainly soft corals and crinoids) (RPS, 2023). Any seabed disturbance impacts (e.g. scouring) are expected to be limited to the immediate vicinity of a pipeline rupture. Given the mobile nature of sediments and high current speeds, the seabed is expected to return to near its original state over time – no substantial changes to seabed features are anticipated.

The existing Bayu-Undan pipeline adjacent to the proposed PLET foundation is in an offshore environment with no other permanent sources of air or water pollution—the air quality is expected to be nearly pristine. A pipeline rupture and subsequent release of dry natural gas potentially could result in a localised and short–term reduction in water and air quality. The plume is likely to move towards the surface as methane (the main component of dry natural gas) is lighter than air, with some gas becoming dissolved in seawater as the plume rises. Any dissolved gas in the water column is expected to disperse rapidly. A worst-case rupture has the potential to form a minor gas cloud, which would rapidly disperse into the atmosphere. Potential changes to water and air quality are expected to be limited to within hundreds of meters of the rupture site and short term (within days).

7.8.2.2 Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds)

Due to the limited solubility of the gas and waters depths, seabed disturbance impacts (e.g. scouring) are expected to be limited to the immediate vicinity of a pipeline rupture. Transient fauna are likely to avoid the water turbulence which would be caused in the event of a rupture. A gas cloud may potentially impact air-breathing fauna, such as marine mammals, reptiles, and birds. Animals in the immediate vicinity of the release may be at risk of

asphyxiation, potentially resulting in death. However, marine mammals, turtles and birds are very unlikely to be affected, given the rapid gas dispersion into the atmosphere. This potential effect would be highly localised (within 500 m) with a short duration and rapidly dispersed within the environment.

The recovery plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) identified pollution as a threat. However, pollution sources were primarily related to agricultural, terrestrial industrial and domestic sources. The accidental chemical releases are expected to be of very short duration and localised extent with no persistence in the environment.

7.8.2.3 Socioeconomic

A dry natural gas cloud could form an explosive mix that, if ignited, results in injury/death and property damage. A gas cloud could risk the health and safety of other users, such as fishers (traditional and commercial), tourism and recreational users. All marine users will be excluded from the construction vessel 500 m exclusion zone; therefore, will not be within 500 m of the event if it occurs. In addition, an unplanned release would enact an emergency response plan to advise other marine users of the hazard.

7.8.2.4 Cultural features

First Nations people feedback was provided about potential impacts from an unplanned dry natural gas release to cultural features during this EP consultations. In accordance with First Nations people cultural beliefs, if totemic species (e.g. turtles) are impacted by the Activity some believe this in turn can impact First Nations people and make them sick. Section 7.8.2.2 describes the potential impact to marine species of cultural significance.

7.8.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No releases of gas from the Bayu-Undan pipeline to the environment as a result of impact/drag or dropped object from the Activity [EPO-16].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-5 to demonstrate that potential risks are ALARP. Control measures that are adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-14: Control measures evaluation for unplanned release: dry natural gas

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C7.1.1	Implement standards and procedures for lifting equipment (administrative control)	Reduces the chance of a dropped suspended load. Load-bearing lifting equipment engineering standards and appropriate lifting procedures factor in technical and environmental variables to minimize the risk of losing control of a suspended load.	Cost of implementing the procedure.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
C7.8.1	Implement procedures for lifting adjacent to live infrastructure (administrative control)	Reduces the chance of a dropped suspended load. Load-bearing lifting equipment engineering standards and appropriate lifting procedures factor in technical and environmental variables to minimize the risk of losing	Cost of implementing the procedure.	**Adopted**

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
		control of a suspended load.		
N/A	Eliminate lifting in the operational area (elimination control)	Reduces the risk of dropped objects.	Lifting is an essential activity for installation activities.	**Rejected** – not feasible to eliminate lifting in the field.

7.8.4 Environmental impact assessment

Receptors	• Physical environment (water quality, air quality) • Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks, rays, other fish, and birds) • Socioeconomic (commercial fishing, traditional fishing, tourism, recreation, shipping and defence) • Cultural features
Consequence	II – Minor
Impacts to water and air quality would be expected, but due to the dispersive nature of the ocean environment and water depths, impacts are expected to be short-term and localised. A dry natural gas release is unlikely to have widespread ecological effects, given the nature of the product, short duration and the limited volume that could be released, and the transient nature of marine fauna in this area. This unplanned event is not considered to have the potential for significant impacts to marine fauna species at the population level. Potential impacts to the physical environment (water and air quality) and marine fauna are considered to be II – Minor. Given the 500 m exclusion zone that will be in force around the construction vessel, subsequent impacts to socioeconomic receptors including commercial fishing and other marine users are not anticipated. For assessment of impacts to marine species of cultural significance, refer to the above paragraphs.	
Likelihood	B – Unlikely
A pipeline rupture incident caused by installation activities with the control measures in place is considered to be unlikely.	
Residual Risk	The residual risk is considered Very Low.

7.8.5 Demonstration of as low as reasonably practicable

A thorough set of controls has been proposed to minimise the risk of damage to the existing Bayu-Undan pipeline and subsequent environmental consequences should they occur.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Very Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.8.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – while several plans identify pollution as a threat to marine fauna, significant impacts are not predicted for this Activity.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – Relevant legislative requirements and standard industry practices have been applied to control the risk. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).

Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – Relevant feedback relating to a potential unplanned dry natural gas release has been considered and the existing control measures are considered adequate to reduce the risk to ALARP.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

Relevant Persons' concerns have been addressed regarding this aspect, and the proposed controls will reduce the residual risk to Very Low and ALARP. Therefore, Santos considers the residual risk associated with the unplanned dry natural gas release to be reduced to an acceptable level.

7.9 Unplanned release: nitrogen gas

7.9.1 Description of event

Event	The Barossa GEP and associated infrastructure, including the initial installation of the GEP PLET protection structure, are outside the scope of this EP. After the Barossa GEP is packed with nitrogen gas, the Barossa GEP and associated infrastructure will be left in situ (preservation period) until the commissioning, start-up and operation activities conducted under the Barossa Production Operations EP. The DPD spool is to be connected to the Barossa GEP PLET, as described in Section 2.5.4.4. Although highly unlikely, an accidental Barossa GEP rupture resulting in the release of nitrogen gas into the environment has the potential to occur from: • a pipe joint impact • unexpected damage to the PLET during the removal and wet parking placement of the Barossa GEP PLET protection structure due to small bore piping damage, rigging instability or rigging failure. The maximum release is approximately 3,000 tonnes of nitrogen gas (100% loss of containment). The Barossa GEP will not contain any project hydrocarbons from the Barossa FPSO. Nitrogen gas is non-flammable and the primary concern is associated with the risk of asphyxiation. However, it is unlikely, given these effects are greatly diminished in the offshore environment given the low and limited volume and rapid dispersion expected.
Extent	The nitrogen dispersion modelling (Add Energy, 2023) for the worst-case release scenario (full bore rupture and calm conditions) predicted that a boil zone has the potential to extend up to 11 m diameter at the sea surface. Nitrogen gas cloud from the boil zone could result in reduced oxygen concentrations (Table 7-15). A 1.5% oxygen reduction may extend up to a height of 13.4 m and 335 m downwind. A 13% oxygen reduction may extend up to a height of 3.8 m and 93 m downwind. Alternatively, a pinhole leak could produce a stream of bubbles that could dissolve before reaching the surface. The nitrogen gas within the Barossa GEP is contained at a relatively low pressure ranging between approximately 10–35 bar. In the event of a rupture, the release of nitrogen would quickly disperse due to the small and finite volume, low pressure, and high dispersion properties.
Duration	Oxygen depletion will be limited to a very short period (within a few hours) immediately following the release. The maximum duration is based on the assumption of a 100% loss of containment.

Nitrogen Gas

Molecular nitrogen is a non-hazardous and non-combustible gas that is colourless, odourless, tasteless, and inert at normal temperatures and pressures (National Center for Biotechnology Information, 2023). It constitutes approximately 78% of the Earth's atmosphere; in the ocean, more than 95% of nitrogen exists as gas (Royal Society, 2013). When released into the environment, nitrogen will rise through the water column (relative density of 0.97), forming a solution with the surrounding water. Rising gas bubbles generate turbulence at the surface when they break the sea surface. This is referred to as the ‘boil zone’ and is accompanied by a radial outflow of water which has been entrained in the plume. The nitrogen gas above the boil zone would disperse into the atmosphere in a buoyant plume, with the potential to form a gas cloud (Add Energy, 2023). High concentrations of nitrogen displace the oxygen in the air resulting in reduced oxygen atmospheres (Table 7-15). Asphyxiation in humans is associated with oxygen levels at 8% or less, or nitrogen concentrations of 620,000 ppm or greater (Add Energy, 2023).

Table 7-15: Oxygen levels associated with nitrogen concentration

Nitrogen concentration (ppm)	Oxygen level reduction (%)	Oxygen level (vol%)
71,000	1.5	19.5
520,000	11	10
620,000	13	8

Source: Add Energy, 2023

7.9.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water and air quality); threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds); socioeconomic (other marine users); and cultural features.

7.9.2.1 Physical environment

The seabed near the existing Barossa GEP PLET is characterised as featureless silty, shelly sand with very sparse (<1%) epibiota (mainly soft corals and crinoids) (RPS, 2023). Any seabed disturbance impacts (e.g. scouring) are expected to be limited to the immediate vicinity of the Barossa GEP rupture. Given the mobile nature of sediments and high current speeds, the seabed is expected to return to near its original state over time – no substantial changes to seabed features are anticipated.

The existing Barossa GEP PLET and GEP is located in an offshore environment with no other permanent sources of air or water pollution—the air quality is expected to be nearly pristine. A Barossa GEP rupture and subsequent release of nitrogen gas potentially could result in a localised and short–term (within hours). A nitrogen gas plume would move towards the surface and given the water depth would facilitate the dissolution of nitrogen in the water column as the plume rises. A worst-case rupture would lead to the formation of a minor gas cloud at the sea surface, which would rapidly disperse into the atmosphere (within minutes). This potential effect would be highly localised (within hundreds of metres) with a short duration and rapidly dispersed within the environment. Due to the limited volumes and expected rapid dispersal below ecological impact thresholds, impacts to physical environment are not expected.

7.9.2.2 Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds)

A gas cloud may potentially impact air-breathing fauna, such as marine mammals, reptiles, and birds. Air-breathing fauna in the immediate vicinity of the release may be at risk of asphyxiation, potentially resulting in death. Li et al (2021) and Galli et al. (2021) suggest that marine mammals and marine turtles have evolved to adapt to hypoxia, including changes in physiology, gene expression regulation and genetic mutations. However, there is limited research of the impacts of high concentrations of nitrogen on these species. The Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017b) identified pollution as a threat. However, pollution sources were primarily related to agricultural, terrestrial industrial and domestic sources. The accidental gas release is expected to be of very short duration and highly localised extent with no persistence in the environment.

Sharks, rays and other fish exposed to high concentrations of nitrogen gas may be at risk of asphyxiation or gas bubble disease (formation of intravascular and extravascular systemic gas bubbles), potentially resulting in death or injury. Given that the closest known fish aggregation site is Shepparton Shoal (approximately 3 km from the PLET)—outside of the extent of a worst-case scenario plume—impacts will likely be limited to transiting individuals and are not considered to result in population–level effects.

Given that the water depth would facilitate the dissolution of nitrogen in the water column and rapid gas dispersion into the atmosphere, the potential effect (injury to or death of an individual animal) would be highly localised (within hundreds of metres) with a short duration (within minutes). This unplanned event is not considered to have the potential for significant impacts to marine fauna species at the population level.

7.9.2.3 Socioeconomic

A nitrogen gas cloud at high concentrations (620,000 ppm) could cause asphyxiation to humans. The nitrogen dispersion modelling (Add Energy, 2023) for the worst-case release scenario (full bore rupture and calm conditions) predicted that the conditions resulting in asphyxiation to humans (≤8% oxygen level) may extend up to a height of 3.8 m and 93 m downwind and may fall outside of the minimum safe working limits (19.5% oxygen level) within a height of 13.4 m and 335 m downwind. A gas cloud could risk the health and safety of other users, such as fishers (traditional and commercial), tourism and recreational users. All other marine users will be excluded from the construction vessel 500 m exclusion zone; therefore, outside the predicted extent if an unplanned event occurs.

7.9.2.4 Cultural features

No First Nations people feedback was provided about potential impacts from an unplanned nitrogen gas release to cultural features arising from the DPD activity during this EP or GEP EP consultations. Section 7.8.2.2 describes the potential impact to marine species of cultural significance.

7.9.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No release of gas from the GEP to the environment as a result of an impact caused from the Activity [EPO-17].

An assessment of the environmental benefits and the potential costs or issues associated with control measures for this activity are described in Table 7-5 to demonstrate that potential risks are ALARP. Control measures that are

adopted have associated EPSs and measurement criteria, and are presented in Table 8-2. Rejected control measures have an ALARP evaluation provided to justify their rejection.

Table 7-16: Control measures evaluation for unplanned release: nitrogen gas

CM reference	Control measure	Environmental benefit	Potential cost/issues	Evaluation
Standard control measures				
C7.1.1	Implement standards and procedures for lifting equipment (administrative control)	Reduces the chance of a dropped suspended load. Load-bearing lifting equipment engineering standards and appropriate lifting procedures factor in technical and environmental variables to minimize the risk of losing control of a suspended load.	Cost of implementing the procedure.	**Adopted**
Additional control measures				
C6.1.8	HSE inductions will include environmental requirements and cultural values (administrative control)	Ensures that crew are aware of the stringent EP, Santos and legislative requirements.	Administrative costs to update existing Santos procedure and induction materials and train personnel.	**Adopted**
N/A	Eliminate lifting in the operational area (elimination control)	Reduces the risk of dropped objects.	Lifting is an essential activity for installation activities.	**Rejected** – not feasible to eliminate lifting in the field.

7.9.4 Environmental impact assessment

Receptors	• Physical environment (water quality, air quality) • Threatened, migratory or local fauna (marine mammals, marine reptiles, sharks, rays, other fish, and birds) • Socioeconomic (commercial fishing, traditional fishing, tourism, recreation, shipping and defence) • Cultural features
Consequence	II – Minor
Impacts to water and air quality would be expected, but due to the dispersive nature of the ocean environment and water depths, impacts are expected to be short-term and localised. The unplanned release is unlikely to have widespread ecological effects. Given that the water depth would facilitate the dissolution of nitrogen in the water column, rapid gas dispersion into the atmosphere and the transient nature of marine fauna in this area, the potential effect (injury to or death of an individual animal) would be highly localised (within hundreds of metres) with a short duration (within minutes). This unplanned event is not considered to have the potential for significant impacts to marine fauna species at the population level. Potential impacts to the physical environment (water and air quality) and marine fauna are considered to be II – Minor. Given the 500 m exclusion zone that will be in force around the construction vessel, subsequent impacts to socioeconomic receptors including commercial fishing and other marine users are not anticipated. For assessment of impacts to marine species of cultural significance, refer to the above paragraphs.	
Likelihood	B – Unlikely
Santos is unaware of any nitrogen release from a pipeline rupture caused by installation activities. A pipeline rupture incident caused by installation activities with the control measures in place is considered to be unlikely.	
Residual Risk	The residual risk is considered Very Low.

7.9.5 Demonstration of as low as reasonably practicable

A thorough set of controls has been proposed to minimise the risk of damage to the existing GEP and GEP PLET and subsequent environmental consequences should they occur.

All reasonably practicable control measures were reviewed and those adopted are considered appropriate to manage the residual risk to a Very Low level. The proposed management controls are in accordance with Santos' risk management criteria and are considered appropriate to reduce the risk to ALARP.

7.9.6 Acceptability evaluation

Is the risk ranked between Very Low and Medium?	Yes – residual risk is ranked Very Low.
Is further information required to validate the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are the risks and impacts consistent with the principles of ecologically sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004), which considers principles of ESD.
Have the acceptable levels of impact and risks been informed by relevant species recovery plans, threat abatement plans and conservation advice and Australian marine park zoning objectives?	Yes – while several plans identify pollution as a threat to marine fauna, significant impacts are not predicted for this Activity.
Are performance outcomes, control measures and associated performance standards consistent with legal and regulatory requirements?	Yes – Relevant legislative requirements and standard industry practices have been applied to control the risk. Through acceptance of this EP, legislative and regulatory requirements will be met as per Section 1.6.2.
Are performance outcomes, control measures and associated performance standards consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy (Appendix A).
Are performance outcomes, control measures and associated performance standards consistent with industry standards?	Yes – the most recent and comparable EPs accepted by NOPSEMA were reviewed for consistency with the performance outcomes, control measures and associated performance standards proposed in this EP.
Have performance outcomes, control measures and associated performance standards taken into consideration Relevant Person feedback?	Yes – no objections or claims were raised regarding a potential unplanned nitrogen gas release.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – ALARP assessment conducted, with additional control measures adopted.

No Relevant Persons concerns have been raised regarding this aspect, and the proposed controls will reduce the residual risk to Very Low and ALARP. Therefore, Santos considers the residual risk associated with the unplanned nitrogen gas release to be reduced to an acceptable level.

8. Implementation strategy

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
(1) The environment plan must contain an implementation strategy for the activity.
Section 22. Implementation strategy for environment plan
Consultation and compliance (16) The implementation strategy must comply with the Act, this instrument, any other regulations made under the Act, and any other environmental legislation applying to the activity.

The specific arrangements that will be implemented in the event of an oil pollution emergency are detailed within the OPEP (BAS-210 0131). Otherwise, Section 8 sets out the implementation strategy for this EP.

8.1 Environmental management system

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Environmental management system (2) The implementation strategy must contain a description of the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity: a. the environmental impacts and risks of the activity continue to be identified and reduced to a level that is as low as reasonably practicable; and b. control measures detailed in the environment plan are effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level; and c. environmental performance outcomes and standards set out in the environment plan are being met.

The Santos Management System exists to support Santos' values and legal obligations to undertake work in a manner that is safe and sustainable. The management system is a framework of policies, standards, processes, procedures, tools and control measures that are designed to ensure:

- compliance with legal obligations (including compliance with an approved EP)
- a common approach is followed across the organisation
- proactive management
- mandatory requirements are implemented and are auditable
- management performance is measured and corrective actions are taken
- opportunities for improvement are recognised and implemented
- workforce commitments are understood and demonstrated.

The implementation strategy for this EP is designed, among other things, so that:

- environmental impacts and risks of the Activity continue to be identified for the duration of the Activity and reduced to a level that is ALARP and an acceptable level
- control measures detailed in this EP are effective in reducing environmental impacts and risks to ALARP and an acceptable level
- environmental performance outcomes and standards set out in this EP are being met
- appropriate consultation with government authorities and relevant interested persons or organisations continues as appropriate for the duration of the Activity.

8.1.1 Environment, health and safety policy

The Activity will be undertaken in accordance with Santos' Environment, Health and Safety (EHS) Policy (Appendix A) which clearly sets out Santos' strategic environmental objectives and the commitment of the management team to continuously improve our management systems and reduce the risk of harm to people and the environment. This EP has been prepared in accordance with the fundamentals of this policy. All Santos

employees are required to complete an EHS Induction on commencing with Santos that includes information on their EHS obligations.

8.1.2 Hazard identification, risk and impact assessment and controls

Hazards and associated environmental risks and impacts for the proposed activities have been systematically identified and assessed in this EP (see Sections 6 and 7) in accordance with Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004). The control measures and EPSs that will be implemented to manage the identified risks and impacts, and the EPOs that will be achieved, are detailed in Section 8.2.

To ensure that environmental risks and impacts remain acceptable and ALARP during the Activity and for the duration of this EP, hazards will continue to be identified, assessed and controlled as described in the sections on Document Management (Section 8.9) and Audits and Inspections (Section 8.10).

Any new or proposed amendment to a control measure, EPS or EPO will be managed in accordance with the Environment Management of Change (MoC) Procedure (EA-91-IQ-10001) (Section 8.9.2). This Procedure also applies to new information about the impacts or risks of the Activity received during the post acceptance consultation implementation process.

Oil spill response control measures, EPSs and EPOs are listed in the OPEP (BAS-210 0131).

8.2 Environmental performance outcomes

OPGGS(E)R 2023 Requirements
Section 21. Environmental assessment
Environmental performance outcomes and standards (7) The environment plan must: a. set environmental performance standards for the control measures identified under paragraph (5)(c); and b. set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured; and c. include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

To ensure environmental risks and impacts will be of an acceptable level, EPOs have been defined and are listed in Table 8-1. These outcomes will be achieved by implementing the identified control measures to the defined EPSs, noting some control measures are applicable to multiple EPOs.

Table 8-1: Environmental performance outcomes

Reference	Environmental performance outcomes
EPO-01	No significant[51] impacts to other marine users.
EPO-02	Seabed disturbance limited to planned activities and defined locations within the OA.
EPO-03	No significant[51] impacts to marine fauna from noise emissions.
EPO-04	No significant[51] impacts to marine fauna from lighting emissions.
EPO-05	Reduce impacts to air quality (GHG and non-GHG emissions) from combustion engines and incinerators by maintaining atmospheric emissions in accordance with standard maritime practices.
EPO-06	Reduce impacts to water quality from activity vessel discharges by maintaining discharge streams in accordance with standard maritime practices.
EPO-07	No impacts to the marine environment from pipeline discharges resulting in a consequence severity greater than Minor.
EPO-08	No loss of equipment/cargo overboard from vessels resulting in a consequence severity greater than Minor.

[51] *'Significant' is defined as 'an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts'. This definition is taken from DoE, 2013.*

Reference	Environmental performance outcomes
EPO-09	Prevent the displacement of native marine species as a result of the introduction and establishment of IMS via activity vessels.
EPO-10	Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with activity vessels.
EPO-11	Zero unplanned release of chemicals to the marine environment.
EPO-12	Zero unplanned release of minor volumes of chemicals and hydrocarbons to the marine environment.
EPO-13	No MDO release to the marine environment.
EPO-14	No significant[51] impacts to cultural features from the Activity.
EPO-15	No significant[51] impacts to underwater cultural heritage from the Activity.
EPO-16	No releases of gas from the Bayu-Undan pipeline to the environment as a result of impact/drag or dropped object from the Activity.
EPO-17	No release of gas from the GEP to the environment as a result of an impact caused from the Activity.

8.2.1 Control measures and performance standards

The control measures that will be used to manage identified environmental impacts and risks and the associated statements of performance required of the control measure (i.e. EPSs) are listed in Table 8-2. Measurement criteria outlining how compliance with the control measure and the expected environmental performance could be evidenced are also listed.

All control measures, EPSs and associated measurement criteria relating to oil spill preparedness and response operations are detailed in the OPEP (BAS-210 0131).

Table 8-2: Control measures and environmental performance standards

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
EPO1	C6.1.1 Activity vessels equipped and crewed in accordance with Australian maritime requirements	EPS6.1.1.1 Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing: • Marine Order 21 (Safety and emergency procedures), including: – safety measures such as manning and watchkeeping. • Marine Order 27 (Safety of navigation and radio equipment), including: – radio equipment and communications – navigation safety measures and equipment – danger, urgency and distress signals and messages. • Marine Order 30 (Prevention of Collisions), including: – lights and signals as applicable to vessel class per COLREGS requirements. • Marine Order 71 (Masters and Deck Officers), including: – all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW requirements.	MC6.1.1.1.1 A Minimum Safe Manning Certificate is in place and identifies minimum crew qualifications to meet the STCW requirements (as applicable for vessel size, type and class).
			MC6.1.1.1.2 Records of Santos marine vessel vetting process (as applicable for vessel size, type and class) to demonstrate the following: • Global Maritime Distress and Safety System (GMDSS) radio logbook maintained • radio equipment available, working and tested at regular intervals • electronic and paper based charts are available on the bridge.
			MC6.1.1.1.3 A Vessel Cargo Ship Safety Equipment Certificate demonstrates the vessel has lights, shapes and means of making sound signals and distress signals in accordance with COLREGS requirements (as applicable for vessel size, type and class).
			MC6.1.1.1.4 Records of vessel crew STCW qualifications align with the Minimum Safe Manning Certificate (as applicable for vessel size, type and class).
			MC6.1.1.1.5 Non-compliance with relevant Marine Orders 21, 27, 30 and 71 and corrective action undertaken documented (as applicable for vessel size, type and class).
	C6.1.2 Undertake consultation with Relevant Persons (including applicable notifications)	EPS6.1.2.1 Consultation with relevant stakeholders will be undertaken in accordance with Relevant Persons consultation plan.	MC6.1.2.1.1 Consultation records demonstrate implementation of a Relevant Persons consultation plan.
		EPS6.1.2.2 AHO Notice to Mariners and AMSA maritime safety information (MSI) will be notified prior to relevant DPD installation activities.	MC6.1.2.2.1 Records demonstrate AHO and AMSA MSI provided sufficient information to generate Notice to Mariners prior to relevant DPD activities.
		EPS6.1.2.3 Infrastructure will be clearly marked on Australian nautical charts published by the AHO.	MC6.1.2.3.1 Evidence of transmittal of subsea infrastructure installed as part of the activities described in this EP to AHO.
		EPS6.1.2.4 Establish a 500 m exclusion zone around the pipelay and construction vessels.	MC6.1.2.4.1 Records demonstrate that the AHO and AMSA MSI were notified that the Notice to Mariners is to include a 500 m exclusion zone around the pipelay and construction vessels.
	C6.1.3 The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes	EPS6.1.3.1 Vessels selected and onboarded in accordance with Santos' Offshore Marine Assurance Procedure (SO-91-ZH-10001) and Santos' Marine Offshore Assurance Criteria (1530-045-STN-0001) to ensure contracted vessels are operated, maintained and crewed in accordance with Santos and industry standards, and regulatory requirements.	MC6.1.3.1.1 Completed documentation in accordance with Santos' Offshore Marine Assurance Procedure (SO-91-ZH-10001).
	C6.1.4 PLET protection structure designed and installed to prevent snag	EPS6.1.4.1 PLET protection structure designed and installed with adequate anti-snag protection.	MC6.1.4.1.1 PLET protection structure technical specifications/design drawings include anti-snag requirements.
			MC6.1.4.1.2 As built surveys demonstrate PLET protection structure was installed.
	C6.1.5 Vessel speed restrictions	EPS6.1.5.1 Vessel speeds within the operational area will be limited to 8 knots or less.	MC6.1.5.1.1 Project induction material includes an environmental requirements section that details speed limit requirements.
			MC6.1.5.1.2 Induction records confirm all project personnel have completed the project induction.
	C6.1.6 One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay	EPS6.1.6.1 An activity vessel will remain in proximity to the pipelay vessel to act as a surveillance vessel during pipelay.	MC6.1.6.1.1 Vessel daily reports record activities aligned with EPS6.1.6.1 requirements.

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
	C6.1.7 Communications plan will be implemented for engagement prior to and during the Activity	EPS6.1.7.1 Communications plan will be implemented for engagement with marine users.	MC6.1.7.1.1 Consultation records demonstrate implementation of a communications plan.
	C6.1.8 HSE inductions will include environmental requirements and cultural values and cultural values	EPS6.1.8.1 All project personnel will attend HSE inductions which will include environmental requirements as required by this EP.	MC6.1.8.1.1 Records demonstrate all project personnel have attended the Activity HSE Induction.
EPO-02	C6.2.1 Confirmation of DPD route prior to and during installation	EPS6.2.1.1 DPD route to be surveyed and confirmed prior to installation.	MC6.2.1.1.1 Records confirm pre-lay DPD route survey completed.
		EPS6.2.1.2 DPD position to be continuously verified during installation.	MC6.2.1.2.1 Records confirm the DPD as-laid survey completed.
	C6.2.2 DP pipelay vessel will be used for installation of the DPD	EPS6.2.2.1 Pipelay vessel will always use DP during pipelay operations.	MC6.2.2.1.1 Records confirm vessel specification for the pipelay vessel include DP.
	C6.2.3 DGPS for pipelay vessel to maintain accurate vessel position during installation	EPS6.2.3.1 Pipelay vessel will always use DGPS during pipelay operations.	MC6.2.3.1.1 Records confirm DGPS equipped pipelay vessel is contracted for the Activity.
	C6.2.4 Underwater acoustic positioning systems used to ensure that designated infrastructure and supporting structures are installed within designed tolerances	EPS6.2.4.1 Calibrated acoustic positioning systems will be used to position PLET (and foundations) at design location.	MC6.2.4.1.1 Installation records record demonstrate that calibrated acoustic positioning systems were used during PLET (and foundations) installation.
			MC6.2.4.1.2 Acoustic positioning system calibration records.
	C6.2.5 Vessel planned maintenance system	EPS6.2.5.1 Documented maintenance program is in place for equipment including DP systems, engines and machinery on vessels that provides a status on the maintenance of equipment.	MC6.2.5.1.1 Records from Santos vessel vetting process confirm planned maintenance system schedule adhered to.
	C6.2.6 Span correction procedures to be developed, if required	EPS6.2.6.1 Span-specific procedures for all span rectifications include: • pre-lay span method selection • provision for real-time monitoring of span rectification activities • post-lay rectification inspection of spans.	MC6.2.6.1.1 A copy of a span rectification procedure (or similar) demonstrating alignment to the EPS6.2.6.1 requirements.
	C6.2.7 No planned vessel anchoring within the OA, within the Habitat Protection Zones (IUCN IV) – Zone 2 of Oceanic Shoals Marine Park or in named banks or shoals	EPS6.2.11.1 No anchoring of activity vessels (unless in an emergency) within the: • OA • Habitat Protection Zones (IUCN IV) – Zone 2 of Oceanic Shoals Marine Park • named banks or shoals.	EPS6.2.11.1.1 Project induction material includes an environmental requirements section that details that no anchoring (unless in an emergency) is permitted within OA, Habitat Protection Zones (IUCN IV) – Zone 2 of Oceanic Shoals Marine Park or named banks or shoals.
			EPS6.2.11.1.2 Induction records confirm all project personnel have completed the project induction.
	C6.2.8 Establish a subsea infrastructure inventory	EPS6.2.8.1 Establish and maintain a comprehensive and accurate inventory of subsea infrastructure and locations.	MC6.2.8.1.1 Subsea infrastructure inventory records.
			MC6.2.8.1.2 Survey reports with installed infrastructure locations.
	C6.2.9 PPUCH for maritime underwater cultural heritage	EPS6.2.9.1 An unexpected finds protocol (Attachment 1 of the PPUCH) will be implemented should an unexpected maritime archaeology find be encountered to minimise impacts to heritage and cultural objects and values. This protocol is to include: • unexpected finds, stop work triggers and notification procedures • object recognition sheet • reporting methods and procedures • artefact collection and curation policies.	MC6.2.9.1.1 A copy of the induction presentation aligns with EPS6.2.9.1 requirements.
			MC6.2.9.1.2 Induction records confirm all project personnel have completed the project induction.
			MC6.2.9.1.3 Notification and heritage response records align with EPS6.2.9.1 requirements.
	C6.2.11	EPS6.2.11.1	MC6.2.11.1.1

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
	PPUCH for First Nations cultural heritage	An unexpected finds protocol (Attachment 2 of the PPUCH) will be implemented should an unexpected First Nations find be encountered to minimise impacts to heritage and cultural objects and values. This protocol is to include: • unexpected finds, stop work triggers and notification procedures • object recognition sheet • reporting methods and procedures • artefact collection and curation policies.	A copy of the induction presentation aligns with EPS6.2.9.1 requirements. MC6.2.11.1.2 Induction records confirm all project personnel have completed the project induction. MC6.2.11.1.3 Notification and heritage response records align with EPS6.2.9.1 requirements.
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
EPO-03	C6.3.1 Avoid activities near cetaceans and turtles.	EPS6.3.1.1 Vessel(s) comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003), which ensures compliance with Part 8 of EPBC Regulations 2000, which includes controls for minimising the risk of collision with marine fauna.	MC6.3.1.1.1 Recorded marine fauna observations demonstrate adherence to EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), including initiation of management measures for when the vessel was operated within a caution zone. MC6.3.1.1.2 Induction records confirm marine fauna interaction and sighting procedure, specifically marine fauna caution zones and controls for minimising the risk of collision with marine fauna, is communicated to all personnel prior to mobilisation.
		EPS6.3.1.2 Any vessel strikes with cetaceans will be reported in the National Ship Strike database.	MC6.3.1.2.1 Contractor incident reports will include evidence of reporting to the National Ship Strike Database (for vessel strike with cetacean incidents.
		EPS6.3.1.3 Helicopter contractor procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003), which ensures compliance with Part 8 of the EPBC Regulations 2000, which includes controls for minimising interaction with marine fauna.	MC6.3.1.3.1 Helicopter contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA 91 II 00003). MC6.3.1.3.2 Induction records confirm marine fauna interaction and sighting procedure, specifically marine fauna caution zones and controls for minimising the risk of collision with marine fauna, is communicated to helicopter operators.
	C6.3.2 A crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours	EPS6.3.2.1 Personnel trained in MFO present on the pipelay vessel during daylight hours, including one crew member with MFO training on the bridge at all times.	MC6.3.2.1.1 Records confirm a minimum of one trained MFO on the pipelay vessel at all times. MC6.3.2.1.2 Records confirm that one crew member that is a trained MFO training is on the bridge at all times during daylight hours.
	C6.3.3 Helicopter planned maintenance system	EPS6.3.3.1 Documented maintenance program is in place for helicopters used on the Activity.	MC6.3.3.1.1 Records confirm a maintenance program is in place and adhered to for helicopters used on the Activity.
	Refer to C6.1.1 (Activity vessels equipped and crewed in accordance with Australian maritime requirements)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.2.5 (Vessel planned maintenance system)		
EPO-04	C6.4.1 The pipelay vessel will have an enclosed pipe welding deck	EPS6.4.1.1 The pipelay vessel shall have an enclosed pipe welding deck to shield light emissions.	MC6.4.1.1.1 Pipelay vessel specification records verify an enclosed pipe welding deck present.
	C6.4.2 Vessel searchlights will only be operated in an emergency	EPS6.4.2.1 Vessel searchlights shall only be operated in an emergency.	MC6.4.2.1.1 Training and induction records for Vessel Masters detail that search lights are to be operated only in an emergency. MC6.4.2.1.2

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
			Visual observations confirm that search light is not illuminated during routine pipelay activities.
	C6.4.3 Lighting will be used as required for safe work conditions and navigational purposes. HSE induction to crew includes minimising light emissions from vessel during night hours where possible.	Refer to EPS6.4.3.1 Vessel navigation lighting and equipment is compliant with COLREGS/Marine Orders 30: Prevention of Collisions, Marine Orders 21: Safety of Navigation and Emergency Procedures, *Navigation Act 2012* (Cth) and Chapter 5 of the International Convention on the Safety of Life at Sea (SOLAS Convention). Work lighting will be the minimum required to maintain safe working conditions for all areas where the crew are operating on the deck.	MC6.4.3.1.1 Vessel certification confirms compliance with applicable regulations.
			MC6.4.3.1.2 Records demonstrate all project personnel have attended the Activity HSE Induction that includes minimising light emissions.
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
EPO-05	C6.5.1 Atmospheric (GHG and non-GHG) emissions from combustion managed in accordance with standard maritime practice	EPS6.5.1.1 Vessels to use only IMO 2020 low sulfur standard MGO or MDO compliant fuel in accordance with MARPOL Annex VI.	MC6.5.1.1.1 Fuel bunkering records and/or relevant purchase records.
		EPS6.5.1.2 Ship Energy Efficiency Management Plan, as relevant to vessel size, type and class.	MC6.5.1.2.1 A copy of the Ship Energy Efficiency Management Plan.
		EPS6.5.1.3 Pursuant to MARPOL Annex VI, vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate and/or Engine IAPP Certificate and/or International Energy Efficiency (IEE) Certificate (or equivalent), as relevant to vessel class and type, which certifies that measures are in place to prevent ODS emissions, and reduce NO_x, SO_x, and incineration emissions during the Activity.	MC6.5.1.3.1 A copy of a current IAPP Certificate (as relevant to vessel class and type).
			MC6.5.1.3.2 A copy of a current Engine IAPP Certificate (or supporting technical file for all of its applicable diesel engines, as relevant to vessel class and type).
			MC6.5.1.3.3 A copy of a current IEE Certificate (or equivalent, as relevant to vessel class and type).
		EPS6.5.1.4 ODS managed in accordance with MARPOL Annex VI to reduce the risk of an accidental release of ODS to air.	MC6.5.1.4.1 A copy of the current and maintained ODS Record Book or recording system.
		EPS6.5.1.5 Incineration is carried out in accordance with MARPOL Annex VI.	MC6.5.1.5.1 Records of an IMO type approval certificate for each incinerator in use, demonstrating the incinerator is designed for operation within the limits of Regulation 16 of MARPOL Annex VI.
		EPS6.5.1.6 Waste from incineration managed in accordance with MARPOL Annex VI.	MC6.5.1.6.1 A copy of the completed Garbage Record Book or official recording system that captures incinerate waste records.
	Refer to C6.1.1 (Activity vessels equipped and crewed in accordance with Australian maritime requirements)		
	Refer to C6.2.5 (Vessel planned maintenance system)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
EPO-06	C6.6.1 Routine discharges of treated bilge and deck water will comply with the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 91	EPS6.6.1.1 Machinery space bilge/oily water shall have IMO approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge.	MC6.6.1.1.1 Supplement to the International Oil Pollution Prevention Certificate that indicates that the vessel has an approved oil / water separator with online monitoring calibrated to discharge at less than 15 ppm OIW, as relevant to relevant to vessel class and type.
		EPS6.6.1.2 A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination.	MC6.6.1.2.1 Records demonstrating that all potential spill sources have appropriate secondary containment capable of controlling discharges of hazardous liquids, particularly high risk areas where of fuel/oil/grease or hazardous chemicals have the potential to enter the marine environment.
		EPS6.6.1.3 Waste oil storage is available.	MC6.6.1.3.1 Records demonstrating waste oil storage is available with suitable containment measures.
		EPS6.6.1.4	MC6.6.1.4.1

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
		Have a valid International Oil Pollution Prevention (IOPP) Certificate, as relevant to vessel class and type.	A copy of a current International Oil Pollution Prevention (IOPP) Certificate, as relevant to vessel class and type.
		EPS6.6.1.5 Maintain an Oil Record Book.	MC6.6.1.5.1 Evidence of a current and maintained Oil Record Book.
		Refer to EPS7.5.6.1 (Vessels have and implement a SOPEP (or equivalent) pursuant to MARPOL Annex I.)	
	C6.6.2 Routine discharges of treated sewage and grey water, in accordance with the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 96 (Marine Pollution Prevention – Sewage)	EPS6.6.2.1 Valid International Sewage Pollution Prevention (ISPP) Certificate (as relevant to vessel class and type) that details the vessel has a: • MARPOL approved sewage treatment plant • sewage comminuting and disinfecting system • sewage holding tank sized appropriately to contain all generated waste (black and grey water).	MC6.6.2.1.1 A copy of valid ISPP Certificate demonstrating the vessel has a MARPOL approved sewage treatment plant (as relevant to relevant to vessel class and type).
			MC6.6.2.1.2 Where the vessel does not have a MARPOL approved sewage treatment plant, records of sewage treated using an approved comminuted and disinfecting system are maintained in an Official Log Book (or similar) that records discharge locations and volumes and verifies that discharge occurred at a distance of more than 3 NM from the nearest land.
			MC6.6.2.1.3 Where the vessel does not have a MARPOL approved sewage treatment plant, records of sewage not comminuted or disinfected are maintained in an Official Log Book (or similar) that records discharge locations and volumes and verifies that discharge occurred at a distance of more than 12 NM from the nearest land.
	C6.6.3 Routine discharges of putrescible waste, in accordance with standard maritime practice and Marine Order 95 (Marine Pollution Prevention – Garbage)	EPS6.6.3.1 A Garbage Record Book is maintained onboard, as relevant to vessel class and type.	MC6.6.3.1.1 Garbage Record Book is current and maintained to capture waste discharge locations, as relevant to vessel class and type.
		EPS6.6.3.2 Garbage Management Plan is in place, as relevant to vessel class and type.	MC6.6.3.2.1 Garbage Management Plan is in place, as relevant to vessel class and type.
		EPS6.6.3.3 Putrescible waste and food scraps are disposed of in accordance with MARPOL Annex V (and Marine Order 95: Marine pollution prevention – garbage).	MC6.6.3.3.1 If a macerator is in use, specifications confirm food scraps are passed through a screen with no opening wider than 25 mm.
			MC6.6.3.3.2 If a macerator is in use, the Garbage Record Book confirms food waste comminuted or ground is discharged no greater than 3 NM to nearest land.
			MC6.6.3.3.3 If food waste is not comminuted or ground, the Garbage Record Book confirms food waste discharge occurred no greater than 12 NM to nearest land or food waste is sent ashore for disposal.
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
EPO-07	C6.7.1 Apply a chemical selection procedure for all chemicals planned to be discharged	EPS6.7.1.1 Chemicals planned to be discharged to sea are Gold/Silver/D or E rated through OCNS, or PLONOR substances listed by OSPAR, or have a complete risk assessment so that only environmentally acceptable products are used.	MC6.7.1.1.1 Records demonstrate the chemical selection procedure has been implemented for all relevant chemicals.
	C6.7.2 Contractor FCGT procedure	EPS6.7.2.1 Contractor FCGT procedure will include: • metering of chemical injection volumes during flooding and hydrotest activities • dosing rates/optimised treatment rates for chemicals.	MC6.7.2.1.1 A copy of the contractor FCGT procedure aligned with requirements listed in EPS6.7.2.1.
			MC6.7.2.1.2 Records demonstrate the chemical selection procedure was implemented for all relevant chemicals.
	C6.7.3 Vertical diffuser for all subsea discharges of treated sea water	EPS6.7.3.1 All subsea discharges of treated sea water will be through a vertical diffuser.	MC6.7.3.1.1 Records demonstrate a vertical diffuser used for discharge of treated sea water.
EPO-08	C7.1.1 Implement standards and procedures for lifting equipment	EPS7.1.1.1 Pipelay and construction vessels crane and lifting operations procedures include controls to reduce the risk of unplanned or dropped objects entering the marine environment and prevent uncontrolled or dragged objects: • lifting equipment certification and inspection • lifting crew competencies	MC7.1.1.1.1 The pipelay and construction vessel's crane and lifting operations procedures align with EPS7.1.1.1 requirements.

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
		• heavy-lift procedures • preventive maintenance on cranes • weather considerations.	
	C7.1.2 Dropped objects recovered where safe and practicable to do so	EPS7.1.2.1 For all dropped objects, the incident documentation will detail the following: • assessment of environmental risk • assessment to recover the object, where safe and practicable to do so • outcomes of the recovery.	MC7.1.2.1.1 Incident documentation details considerations and outcomes of recovery of dropped objects.
	C7.1.3 Chemicals and hydrocarbons will be managed in accordance with standard maritime practices	EPS7.1.3.1 Chemicals and hydrocarbons managed in accordance with SDS in relation to safe handling and storage, spill response and emergency procedures, and disposal considerations.	MC7.1.3.1.1 Records of contractor vessel audits and/or inspections demonstrate compliance with chemical and hydrocarbon storage and handling requirements.
			MC7.1.3.1.2 Accidental loss of chemicals overboard contained in incident documents.
		EPS7.1.3.2 SDS available for all chemicals to help identify hazards and to manage chemicals.	MC7.1.3.2.1 Completed vessel inspection checklist aligned with the EPS7.1.3.2 requirements.
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.6.3 (Routine discharges of putrescible waste, in accordance with standard maritime practice and Marine Order 95 [Marine Pollution Prevention – Garbage])		
EPO-09	C7.2.1 Vessels equipped with effective anti-fouling coatings	EPS7.2.1.1 Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (as applicable for vessel size, type and class), including: • Marine Order 98 (Marine Pollution – Anti-fouling Systems) including (as required by vessel class): – a valid International Anti-fouling System Certificate.	MC7.2.1.1.1 A copy of an approved International Anti-fouling System Certificate.
	C7.2.2 Vessels undertake ballast water management or treatment to achieve low-risk ballast water	EPS7.2.2.1 Ballast water discharges will comply with the Australian Ballast Water Management Requirements (DAWE, 2020a), which implements the requirements of the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class).	MC7.2.2.1.1 Records demonstrating a Ballast Water Management Plan (electronic or in hard copy) is in place.
			MC7.2.2.1.2 Records demonstrating a ballast water record system (electronic or in hard copy) is maintained.
			MC7.2.2.1.3 An International Ballast Water Management Certificate is in place and demonstrates the principal ballast water management method is in accordance with D-2 standards.
			MC7.2.2.1.4 If the vessel cannot demonstrate it meets D-2 standards, records of ballast water discharge logs confirm no discharge within 12 nautical miles of coastlines including any ports.
			MC7.2.2.1.5 A Biosecurity Status Document showing an approved ballast status (for vessels arriving from international locations) or a low risk exemption through a domestic ballast water risk assessment (for domestic vessels).
	C7.2.3 Apply risk-based IMS management for vessels	EPS7.2.3.1 Vessels will comply with the Australian Biofouling Management Requirements (DAFF, 2023) (as appropriate to class), including: • vessels equipped with a Biofouling Management Plan • vessels maintain a Biofouling Record Book.	MC7.2.3.1.1 Vessels equipped with a Biofouling Management Plan.
			MC7.2.3.1.2 Vessels maintain a Biofouling Record Book.

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
		EPS7.2.3.2 Vessels mobilised to the OA from international or domestic waters will comply with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2009): • completion of IMS Risk Assessment, which includes submission of evidence that demonstrates the implementation of mitigation measures to reduce risk (using either the Vessel Check system or as described in Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry ([Marine Pest Sectoral Committee, 2009]) • only vessels classified as a low-level risk used on the project.	MC7.2.3.2.1 Records demonstrate compliance with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2009), including: • completion of IMS Risk Assessment, which includes submission of evidence that demonstrates the implementation of mitigation measures to reduce risk (using either the Vessel Check system or as described in Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry [Marine Pest Sectoral Committee, 2009]) that classifies the vessel as low risk.
	C7.2.4 Marine Growth Prevention System	EPS7.2.4.1 Vessels will have a marine growth prevention system or appropriate manual treatment systems.	MC7.2.4.1.1 Records of quarantine management system process demonstrate vessels have a marine growth prevention system or appropriate manual treatment systems.
	Refer to C6.1.3 (The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
EPO-10	Refer to C6.1.5 (Vessel speed restrictions)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.3.1 (Avoid activities near cetaceans and turtles)		
	Refer to C6.3.2 (A crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours)		
EPO-11	C7.4.2 Pipeline installation procedure	EPS7.4.2.1 The contractor will have an installation procedure which will include: • DP alarm systems to indicate vessel position loss • minimum tensioner alarms to ensure pipeline catenary is maintained • visual monitoring of DPD relative to stinger.	MC7.4.2.1.1 The pipeline installation procedure (or similar) details EPS7.4.2.1 requirements.
	Refer to C6.2.3 (DGPS for pipelay vessel to maintain accurate vessel position during installation)		
	Refer to C6.7.1 (Apply a chemical selection procedure for all chemicals planned to be discharged)		
	Refer to C6.7.2 (Contractor FCGT procedure)		
EPO-12	C7.5.1 Chemical and hydrocarbon storage areas designed to contain leaks and spills	EPS7.5.1.1 Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically: • appropriate procedures for storage (e.g. bunding), labelling (including SDS available) and handling of chemicals and hydrocarbons • completion of vessel OVID/CMID/Santos approved inspection and report • implementation of a permit to work or equivalent authorisation process (e.g. job safety analysis) for bunkering.	MC7.5.1.1.1 A copy of chemical procedures (or similar) that include storage (e.g. bunding), labelling (including SDS available) and handling of chemicals and hydrocarbons. MC7.5.1.1.2 Records of contractor vessel OVID/CMID/Santos approved inspection.
	C7.5.3	EPS7.5.3.1	MC7.5.3.1.1 Contractor vessel audit process confirm spill kits stocked and ready for use.

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
	Spill clean-up kits available in high-risk areas	Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically spill kits stocked and ready for use by trained personnel.	
	C7.5.4 No PFAS or PFOS will be used in firefighting foam.	EPS7.5.4.1 Fire-fighting foams shall be free of PFAS and PFOS.	MC7.5.4.1.1 SDS for firefighting foam to confirm no PFAS or PFOS.
	C7.5.5 ROV operations undertaken in accordance with good industry practice.	EPS7.5.5.1 Preventive maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea.	MC7.5.5.1.1 Vessel contractor written verification demonstrates compliance with planned maintenance system.
		EPS7.5.5.2 ROV pre-mobilisation audit completed to reduce the risk of hydraulic fluid releases to sea.	MC7.5.5.2.1 Records of a pre-mobilisation audit for ROV operations.
	C7.5.6 Vessel spill response plans	EPS7.5.6.1 Vessels have and implement a SOPEP (or equivalent) pursuant to MARPOL Annex I.	MC7.5.6.1.1 Approved SOPEP (or equivalent) in place.
			MC7.5.6.1.2 Spill details contained in incident documentation.
		EPS7.5.6.2 Spill response exercises conducted in accordance with SOPEP to ensure personnel are prepared.	MC7.5.6.2.1 Spill exercise records or evidence of a spill exercise aligned with the EPS7.5.6.2 requirements.
	C7.5.7 Helicopter refuelling procedure	EPS7.5.7.1 Helicopter refuelling procedures to include: • completed permit to work and/or job safety analysis for the Activity • continual visual monitoring of gauges, hoses, fittings and the sea surface during the Activity • hose and fittings checks before starting the Activity • weather conditions to be assessed before the Activity.	MC7.5.7.1.1 Refuelling procedure aligned with EPS7.5.7.1 requirements.
	Refer to C6.1.1 (Activity vessels equipped and crewed in accordance with Australian maritime requirements)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.2.5 (Vessel planned maintenance system).		
	Refer to C7.1.3 (Chemicals and hydrocarbons will be managed in accordance with standard maritime practices)		
EPO-13	C7.6.1 No IFO or HFO will be used in activity vessels	EPS7.6.1.1 Vessel tanks to be free of HFO or IFO.	MC7.6.1.1.1 A copy of vessel contracts stating vessel tanks to be free of HFO or IFO.
	C7.6.2 Accepted OPEP	EPS7.6.2.1 In the event of an oil spill to sea, OPEP (BAS-210 0131) requirements will be implemented to mitigate environmental impacts.	MC7.6.2.1.1 Completed incident documentation demonstrating the use of the OPEP (BAS-210 0131).
	C7.6.3 Vessel-specific bunkering procedures and equipment consistent with Santos marine vessel vetting requirements	EPS7.6.3.1 Santos will confirm vessel bunkering procedures include: • defined roles and responsibilities – bunkering to be undertaken by trained staff • use of bunkering hoses that have quick connection couplings • visual inspection of hose prior to bunkering to confirm they are in good condition and correct valve line up • assessment of weather and sea state • testing of emergency shutdown mechanism on the transfer pumps • established communication protocols between vessel master and personnel responsible for monitoring tank levels, leaks and overflows during bunkering operations	MC7.6.3.1.1 The vessel's refuelling procedure aligned with the EPS7.6.3.1 requirements.

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
		• continual visual monitoring during MDO transfers of hoses, connections and tank levels to detect leaks and prevent overflows during bunkering operations.	
	Refer to C6.1.1 (Activity vessels equipped and crewed in accordance with Australian maritime requirements)		
	Refer to C6.1.2 (Undertake consultation with Relevant Persons [including applicable notifications])		
	Refer to C6.1.3 (The Activity will be undertaken in accordance with Santos HSE management and marine vessel vetting processes)		
	Refer to C6.1.5 (Vessel speed restrictions)		
	Refer to C6.1.6 (One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.2.5 (Vessel planned maintenance system)		
	Refer to C7.5.6 (Vessel spill response plans)		
EPO-14	C6.2.10 Cultural heritage training and cultural ceremony	EPS6.2.6.1 • Cultural training completed by all site-based workforce (Santos employees and contractors) by end of their first rotation offshore. • Cultural heritage monitors to provide an introduction to the Activity to the seas and any First Nations spiritual beings at commencement of the Activity.	MC6.2.6.1.1 Progress reporting as part of the EP Annual Environmental Performance Report.
	Refer to C6.1.5 (Vessel speed restrictions)		
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C6.2.11 (PPUCH)		
	Refer to C6.3.2 (A crew member trained in marine fauna observations (MFO) will be present on the pipelay vessel bridge at all times during daylight hours)		
	Refer C6.7.1 (Apply a chemical selection procedure for all chemicals planned to be discharged)		
EPO-15	Refer to C6.2.1 (Confirmation of DPD route prior to and during installation)		
	Refer to C6.2.9 (PPUCH)		
	Refer to C6.2.11 (PPUCH)		
EPO-16	C7.8.1 Implement procedures for lifting adjacent to live infrastructure	EPS7.8.1.1 Santos will confirm the vessel procedures for lifting adjacent to live infrastructure include: • that the vessel is offset from the Bayu-Undan pipeline (outside of lift exclusion zones) • objects are slowly ‘walked’ to the target location at a reduced height above the seabed • survey system and lift exclusion zones.	MC7.8.1.1.1 A copy of the procedures for lifting adjacent to live infrastructure aligned with the EPS7.8.1.1 requirements.
	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		

EPO reference (Table 8-1)	Control measure	Environmental performance standard	Measurement criteria
	Refer to C7.1.1 (Implement standards and procedures for lifting equipment)		
EPO-17	Refer to C6.1.8 (HSE inductions will include environmental requirements and cultural values)		
	Refer to C7.1.1 (Implement standards and procedures for lifting equipment)		

8.3 Leadership, accountability and responsibility

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Responsibilities of employees and contractors (3) The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the environment plan, including during emergencies or potential emergencies.

Santos' Pipeline Delivery Manager is accountable for the implementation, management and review of this EP.

The effective implementation of this EP requires collaboration and cooperation among Santos and its contractors. The chain of command and accountabilities of personnel in relation to implementing, managing and reviewing this EP is outlined in Table 8-3. It is also outlined in the OPEP (BAS-210 0131) for oil spill response.

Table 8-3: Chain of command, key leadership roles and responsibilities

Role	Responsibilities
Office-based personnel	
Santos Pipeline Delivery Manager	• Accountable for implementation of this EP • Responsible for communication of Santos' policies and standards to all employees and contractors for their adherence to the same • Promotes HSE as a core value integral with how Santos does its business • Empowers personnel to 'stop-the-job' due to HSE concerns • Provides resources for HSE management • Promotes a high level of HSE performance and drives improvement opportunities • Responsible for development and implementation of emergency response plans • Maintains communication with Santos personnel, government agencies and the media • Approves MoC documents, if acceptable and ALARP • Responsible for completion of annual HSE improvement plan
Santos Barossa HSE Manager	• Provides resources for HSE management • Responsible for developing a program to implement and monitor EP commitments • Responsible for liaising with NOPSEMA • Responsible for establishing an incident notification process and confirming that investigations are completed to identify root causes • Responsible for reviewing and submitting monthly and end of activity reports
Santos Barossa GEP Package Lead	• Accountable for implementation of this EP • Accountable for communicating any changes to the Activity that may affect the risk and impacts assessment, EPOs, EPSs and MC detailed in this EP to the Santos HSE team • Responsible for providing the resources required to enable the commitments in this EP to be maintained • Accountable for confirming the reporting of environmental incidents meets both external and Santos incident reporting requirements • Responsible for liaising with Santos Environmental Advisor on environmental incidents and what constitutes a reportable incident • Accountable for tracking and closing out of any corrective actions raised from environmental audits as required by this EP
Santos Barossa GEP Engineer	• Responsible for conformance with environmental performance outcomes and standards in this EP • Delegates HSE responsibility and informs these personnel of their responsibilities under this EP • Empowers personnel to 'stop-the-job' due to HSE concerns • Responsible for compliance with processes for HSE incident reporting, investigation, correction and communication

Role	Responsibilities
	• Responsible for compliance with processes for HSE inspections and audits and implementation of corrective actions • Reviews MoC documents •
Santos Barossa Marine Director	• Responsible for conformance with environmental performance outcomes and standards in this EP • Delegates HSE responsibility and informs these personnel of their responsibilities under this EP • Empowers personnel to 'stop-the-job' due to HSE concerns • Responsible for compliance with processes for HSE incident reporting, investigation, correction and communication • Responsible for vessel compliance with quarantine requirements to operate in Australian waters • Responsible for compliance with processes for HSE inspections and audits and implementation of and corrective actions • Reviews MoC documents • Responsible for compliance with requirements for personnel on the vessels to have the necessary qualifications, training and/or supervision
Contractor Project Manager	• Responsible for implementing the Activity in accordance with this EP • Responsible for providing the resources required to enable the commitments in this EP to be maintained • Responsible for completing a biofouling risk assessment and obtaining a 'low' risk status for all activity vessels mobilised to the OA (Section 8.6.5) • Responsible for all crew attending HSE inductions and saving attendance records • Responsible for reporting and investigating incidents , as required
Santos Barossa Environmental Adviser	• Monitoring conformance with EPOs and environmental performance standards, and the implementation strategy in this EP • Prepares, maintains and distributes the environmental compliance register • Completes regular HSE reports, inspections and audits • Completes HSE inductions and promotes general awareness • Collates HSE data and records • Contributes to HSE incident management and investigations • Provides operational HSE oversight and advice • Facilitates the development and implementation of MoC documents • Provides incident reports, compliance reports and notifications to NOPSEMA • Responsible for fulfilment of Relevant Persons consultation and communication requirements • Responsible for communication of EP requirements to subcontractors
Santos Relevant Person Coordinator	• Responsible for implementation of the steps described in Section 8.11 relating to post acceptance consultation throughout the duration of the Activity • Maintains a Relevant Persons contact and information database • Maintains a Relevant Persons Notification Log specific to this EP • Maintains records of all Relevant Persons correspondence specific to this EP • Before the Activity begins and on advice of Santos Barossa Environmental Adviser, notifies all Relevant Persons listed, or as revised, in accordance with Table 8-5 • Is available before, during and after the Activity to promote opportunities for Relevant Persons to provide feedback • Internally communicates new risks and (or) controls that are raised during post acceptance consultation • Prepares quarterly updates
Santos Emergency Response Adviser	• Provides overarching incident and crisis management responsibility • Manages the crisis management team (CMT) and IMT personnel training program • Reviews and assesses competencies for CMT, IMT, and field-based incident response team members

Role	Responsibilities
	• Manages the duty roster system for CMT and IMT personnel • Manages the maintenance and readiness of incident response resources and equipment
Santos Oil Spill Response Adviser	• Provides ongoing guidance, framework, and direction on the OPEP (BAS-210 0131) • Develops and maintains arrangements and contracts for incident response support from third parties • Develops and defines objectives, strategies and tactical plans for response preparedness defined in the OPEP (BAS-210 0109) • Undertakes assurance activities on arrangements outlined within the OPEP (BAS-210 0131)
Offshore-based personnel	
Santos Senior Client Site Representative	• Confirms contractors undertake the Activity in a manner consistent with the EPOs and environmental management procedures detailed in this EP • Confirms the management measures detailed in this EP are implemented • Confirms that the Vessel Master and all crew adhere to the requirements of this EP • Advises the Santos Pipeline Delivery Manager of any activity changes that may lead to a non-conformance with the requirements with this EP • Reports environmental incidents to the Santos Pipeline Delivery Manager
Vessel Master (contractor personnel)	• Responsible for compliance with all HSE laws, conventions and approvals (e.g. safety case) • Responsible for conformance with delegated environmental performance outcomes and standards in this EP • Reports any new, or increase in, HSE risk or impact • Responsible for compliance with MoC procedures • Responsible for adherence by crew to operational work systems and procedures • Responsible for implementation of requirements that the vessel and equipment is being operated as intended and is maintained • Empowers personnel to ‘stop-the-job’ due to HSE concerns • Responsible for compliance with reporting requirements for all HSE incidents, hazards and non-conformances • Facilitates HSE investigations and is responsible for the implementation of corrective actions • Responsible for compliance with requirements for crew to be competent and prepared to respond to HSE incidents
Marine Fauna Observer (MFO)s	In addition to the requirements of vessel crew, the MFOs will: • Undertake visual observations for marine fauna as per this EP • Record all sightings of marine fauna • Advise vessel master of sightings of marine fauna and vessel requirements • Provide additional training to crew in fauna observations as required
Offshore Construction Superintendent (Contractor Personnel)	• Responsible for implementing the installation activities in accordance with this EP.
Offshore HSE Advisers (Santos and/or contractor)	• Responsible for supporting the Santos Senior Client Site Representative to implement the requirements within this EP and assisting to collect and record environmental assurance evidence • Responsible for supporting the Santos Senior Client Site Representative to report environmental incidents or breaches of outcomes or standards outlined in this EP and develop, track and close out corrective actions for incidents and breaches are in a timely manner • Responsible for completing periodic environmental inspections/reviews and developing, tracking and closing out corrective actions from inspections are in a timely manner • Responsible for reviewing contractors’ procedures and providing input into toolbox talks and job safety analyses • Responsible for providing day-to-day environmental support for activities in consultation with the Santos Barossa Environmental Adviser

Role	Responsibilities
	•

8.4 Workforce training and competency

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Responsibilities of employees and contractors (4) The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of the employee's or contractor's responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.

This section describes the mechanisms that will be in place so that each employee and contractor is aware of their responsibilities in relation to this EP and has appropriate training and competency.

8.4.1 Activity inductions

Inductions addressing environmental management requirements are to be implemented and to include information about:

- Santos' Environment, Health and Safety Policy (Appendix A) and management system
- the applicable regulatory regimes
- environmental sensitivities (e.g. nearby protected marine areas, sensitive environmental periods)
- communications to avoid vessel interaction
- activities with highest risk (e.g. IMS and hydrocarbon releases)
- relevant EP commitments (e.g. Table 8-1, Table 8-2)
- incident reporting and notifications
- regulatory compliance reporting
- MoC process
- oil pollution emergency response (e.g. OPEP requirements)
- maritime and First Nations cultural heritage awareness.

8.4.2 Training and competency

All members of the workforce on the activity vessels will complete relevant training and hold qualifications and certificates for their role. Santos and its contractors are individually responsible for ensuring that their personnel are qualified and trained. The systems, procedures and responsible persons will vary and will be managed by using online databases, staff onboarding processes and training departments, etc.

Personnel qualification and training records will be sampled before and/or during an activity. These checks will be performed during the procurement process, inductions, crew change, and operational inspections and audits.

Additional training and competency requirements for Relevant Personnel specific to spill response are provided in the OPEP (BAS-210 0131).

8.4.3 Workforce involvement and communication

Daily operational meetings will be held at which HSE will be a permanent agenda item. It is a requirement that supervisors attend daily operational meetings and that all personnel attend daily toolbox or pre-shift meetings. Toolbox or pre-shift meetings will be held to plan jobs and discuss work tasks, including HSE risks and their controls.

HSE performance will be monitored and reported during the Activity, and performance metrics (e.g. number of environmental incidents) will be regularly communicated to the workforce. Workforce involvement and environmental awareness will also be promoted by encouraging offshore personnel to report marine fauna sightings and marine pollution (e.g. oil on water, dropped objects).

8.5 Emergency preparedness and response

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Oil pollution emergency response (8) The implementation strategy must contain an oil pollution emergency plan and provide for updating the plan. (9) The oil pollution emergency plan must include adequate arrangements for responding to and monitoring oil pollution, including the following: a. the control measures necessary for timely response to an emergency that results or may result in oil pollution; b. the arrangements and capability that will be in place, for the duration of the activity, to ensure timely implementation of the control measures, including arrangements for ongoing maintenance of response capability; c. the arrangements and capability that will be in place for monitoring the effectiveness of the control measures and ensuring that the environmental performance standards for the control measures are met; d. the arrangements and capability in place for monitoring oil pollution to inform response activities. (10) The implementation strategy must provide for monitoring of impacts to the environment from oil pollution and response activities that: a. is appropriate to the nature and scale of the risk of environmental impacts for the activity; and b. is sufficient to inform any remediation activities. (11) The implementation strategy must include information demonstrating that the response arrangements in the oil pollution emergency plan are consistent with the national system for oil pollution preparedness and response. *Testing oil pollution emergency response arrangements* (12) The implementation strategy must include arrangements for testing the response arrangements in the oil pollution emergency plan that are appropriate to the response arrangements and to the nature and scale of the risk of oil pollution for the activity. (13) The arrangements for testing the response arrangements must include: a. a statement of the objectives of testing; and b. a proposed schedule of tests; and c. mechanisms to examine the effectiveness of response arrangements against the objectives of testing; and d. mechanisms to address recommendations arising from tests. (14) The proposed schedule of tests must provide for the following: a. testing the response arrangements when they are introduced; b. testing the response arrangements when they are significantly amended; c. testing the response arrangements not later than 12 months after the most recent test; d. if a new location for the activity is added to the environment plan after the response arrangements have been tested, and before the next test is conducted–testing the response arrangements in relation to the new location as soon as practicable after it is added to the plan; e. if a facility becomes operational after the response arrangements have been tested and before the next test is conducted–testing the response arrangements in relation to the facility when it becomes operational.

Vessels must have and must implement incident response plans, such as an emergency response plan and SMPEP or SOPEP. Regular incident response drills and exercises (e.g. as defined in an emergency response plan, SMPEP or SOPEP) will be performed to refresh the crew in using equipment and implementing incident response procedures.

The OPEP (BAS-210 0131) is a stand-alone document that details spill management arrangements, including the Santos incident management structure.

The OPEP provides Activity information comprising:

- a description of the spill profile
- applicable response strategies and control measures
- net environmental benefit analysis (NEBA)
- spill response ALARP assessment
- arrangements for testing the response arrangements
- arrangements for impact monitoring.

Santos will implement the OPEP in the event of a hydrocarbon spill. The OPEP details how Santos will prepare and respond to a spill event and meets the requirement of the OPGGS(E)R 2023, including to addresses the requirements of section 22(8)-(14) inclusive.

8.6 Supporting management processes and procedures

8.6.1 Contractor health, safety and environment requirements

Santos' HSE Contractor Management Operating Standard (SMS-HSS-OS08) supports the minimum requirements and expectations for HSE management of contractors and subcontractors. In addition, the Barossa Gas Project has a contractual HSE exhibit for the subsea scopes of work. The HSE exhibit has a detailed environmental requirements section for:

- contractor to determine environmental risks and proposed controls
- understanding and compliance with applicable environmental legislation
- contractor group to have involvement in meeting environmental requirements
- this EP used to manage environmental risks
- key activities to support continuous environmental improvement
- definition of the OA
- chemical selection and approvals
- prohibition of materials and chemicals
- vessel requirements.

The HSE requirements for contracts/contractor management during pre-contract planning, contracting, contract execution and contract completion and evaluation are outlined in the HSE Contractor Management Operating Standard (SMS-HSS-OS08) and include these minimum requirements:

- contractors must comply with all applicable HSE laws and regulations and any additional guidelines, operating standards and policies provided to the contractor
- a review of the contractor's HSE management system must be completed by Santos before contract is awarded.
- Santos can conduct audits/inspections of the contractor's operations, equipment and emergency procedures at any time.

8.6.2 Santos marine vessel vetting process

Santos manages marine vessel vetting and assurance using a hierarchy of procedures, outlined below. These requirements for vessel acceptance criteria include technical, personnel (e.g. crew competencies) and operational requirements for marine vessels engaged by Santos.

8.6.2.1 Marine vetting and audit process manual for offshore vessels

Santos' Offshore Marine Assurance Procedure (SO-91-ZH-10001) is a standard that requires all vessels used by Santos to be vetted. The vetting process is based on industry standards and best practices, along with considerations of guidelines and recommendations from recognised industry organisations such as Oil Companies International Marine Forum (OCIMF) and International Maritime Contractors Association (IMCA), and international regulatory agencies like the IMO and vessel classification societies.

Santos' Offshore Marine Assurance Procedure (SO-91-ZH-10001) requires a valid Offshore Vessel Inspection Database (OVID) report or Common Marine Inspection Document (CMID) report as required for vessel operation types.

For vessels where the OVID and/or CMID are not valid or available, a Santos approved inspection report is required.

8.6.2.2 Marine operations manual

The Marine Operations Manual (IOSC/OPS/HBK/0003) details:

- standard operating procedures for all vessels under contract with Santos

- compliance requirements for relevant maritime legislation and relevant guidelines, standards and codes
- compliance requirements for international conventions and agreements, including:
  - International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004
  - SOLAS 1974 and its Protocol of 1988
  - International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)
  - Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)
  - International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers, 1978.
- compliance requirements for industry standards as set up by:
  - OCIMF
  - IMCA
  - Guidelines for Offshore Marine Operations
  - Nautical Institute.
- Santos and contractor standards, procedures and best practice management, including:
  - vessels' safety of navigation
  - vessels using DP systems
  - vessels' bunkering procedures
  - crew competency and training records
  - biosecurity management
  - chemical storage and handling procedures
  - discharge management procedures
  - waste management procedures
  - anchoring procedures
  - vessel and equipment maintenance procedures as per the vessel-specific safety management system.

Before commencing activities, Santos performs a risk assessment or HSE qualification evaluation process for each vessel to identify any HSE issues or specific management requirements.

8.6.3 Santos waste management process

Waste management will be undertaken in a manner consistent with Santos' waste management processes, including application of the waste management hierarchy, classification and segregation of waste streams, appropriate storage, transportation requirements, record management (e.g. waste inventories and tracking), use of licenced contractors/facilities and auditing.

8.6.4 Ballast water management

8.6.4.1 Summary of requirements

The Australian ballast water management requirements set out the obligations on vessel operators regarding managing ballast water and ballast tank sediment when operating within Australian seas. These requirements include legislative obligations under the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments. The requirements provide guidance for vessel operators on best practice policies and apply to all vessels operating internationally and domestically in Australia. All vessels designed to carry ballast water (as applicable to vessel class) are required to carry the following:

- a valid ballast water management plan
- a valid international ballast water management certificate
- a type approval certificate specific to the type of ballast water management system installed (if installed)

- maintenance of a complete and accurate record of all ballast water movements, including those conducted in Australian waters.

Ballast water exchange should be conducted in areas at least 12 Nm from the nearest land and in water at least 50 m deep (having regard to the D-2 standard exemptions in the Australian Ballast Water Management Requirements [DAWE, 2020a]). Volumetric exchange must be at least 95% of the relevant tank.

Records on ballast water exchange must include the start and finish times and geographic coordinates of the operation.

All ballast water management equipment, such as pumps, will be maintained per the vessel's preventive maintenance system and regularly tested to ascertain accurate calculations for ballast water exchange operations.

8.6.4.2 Australian pre-arrival report

All international vessels (intending to ballast) must submit a pre-arrival report (through the Maritime Arrival Reporting System [MARS]) at least 12 hours prior to arrival. The Ballast Water Report will be assessed by the DAFF through MARS, and a response will be issued through the Biosecurity Status Document. Domestic vessels can request a low-risk exemption through a domestic risk assessment through MARS.

MARS is the online portal used by commercial vessel masters and shipping agents to submit the reports required of all international vessels seeking Australian biosecurity clearance and to request services such as coastal strip, waste removal, ship sanitation certification and crew change.

DAFF will request evidence from vessels with a ballast water management system of:

- a valid ballast water management plan specific to the vessel (consistent with the Ballast Water Management Convention)
- a valid ballast water management certificate, or certificate of compliance, that is approved by a port state administration, or a recognised survey authority (consistent with the Convention)
- ballast water management records clearly demonstrate the ballast water management system has been operated consistently with the ballast water management plan.

A DAFF biosecurity officer may board the vessel to verify the pre-arrival report and personnel proficiency in the operation and maintenance of the ballast water management system.

8.6.5 Biofouling management

IMS may be present as biofouling on the vessel hull or within piping, sea chests, etc. Biofouling, which may be found on and in a vessel, reflects the vessel's design, construction, maintenance and operations. Each of these aspects introduces particular biofouling vulnerabilities but also offers opportunities to limit the extent and development of biofouling, with commensurate reduction in biosecurity risks.

8.6.5.1 Summary of requirements

Biofouling management for international vessels will comply with the Australian biofouling management requirements (DAFF, 2023), which implements the requirements of the *Biosecurity Act 2015* (Cth) and the IMO 2011 Guidelines for the Control and Management of Ships' biofouling to Minimize the Transfer of Invasive Aquatic Species.

Under the new regulations, all operators of vessels intending to enter Australian territorial waters must provide information relating to biofouling management through the mandatory pre-arrival report 12–96 hours prior to arrival. In addition, the vessel operator must demonstrate proactive management of biofouling by implementing one of the 3 accepted proactive biofouling management options:

- implementation of an effective biofouling management plan and record book
- cleaned all biofouling within 30 days prior to arriving in Australian territory
- implementation of an alternative biofouling management method pre-approved by the department.

Vessels mobilised to the OA from international or domestic waters must also comply with the National biofouling management guidelines for the petroleum production and exploration industry (Marine Pest Sectoral Committee, 2009).

8.6.5.2 Vessel risk assessment

This includes:

- completing a biofouling risk assessment
- implementing mitigation measures commensurate with the level of risk.

Figure 8-1 illustrates the risk assessment process. Factors that will inform risk include:

- timing of marine pest risk assessment relative to the activity vessel mobilisation to provide sufficient time to implement control measures in cases where management is warranted
- activity vessel location history since last dry dock and clean to inform whether the activity vessel may have been exposed to high-risk ports/locations
- level of biofouling and the presence of species of concern (particularly the presence of marine pests) within biofouling communities on the vessels associated with the Activity (often informed by biofouling record books and/or maintenance/cleaning or inspection programs)
- operational profile relevant to biosecurity risk such as operating speed, time alongside a facility and the need for ballast exchanges within the title area
- receiving environment including the presence of shallow-water sensitivities near the Activity and the presence and area of non-biocidal surfaces on facilities that could harbour marine pests
- presence and effectiveness of external and internal marine growth prevention systems including effectiveness and integrity of anti-fouling coatings and functionality of internal treatment systems
- qualifications and competency of those conducting and reviewing the risk assessment and making management decisions.

8.6.5.3 Vessel risk status

Vessels must achieve a 'low' risk status to demonstrate to the government that Santos has taken all reasonable measures to minimise the risk of IMS. The risk assessment categorises the vessel's risk status as:

- low – low risk of introducing IMS; no additional management measures required
- uncertain – risk of introducing IMS is not apparent; precautionary approach adopted, additional management measures required to achieve low status
- high – high risk of introducing IMS; additional management measures will be required.

8.6.5.4 Potential management measures to achieve low risk status

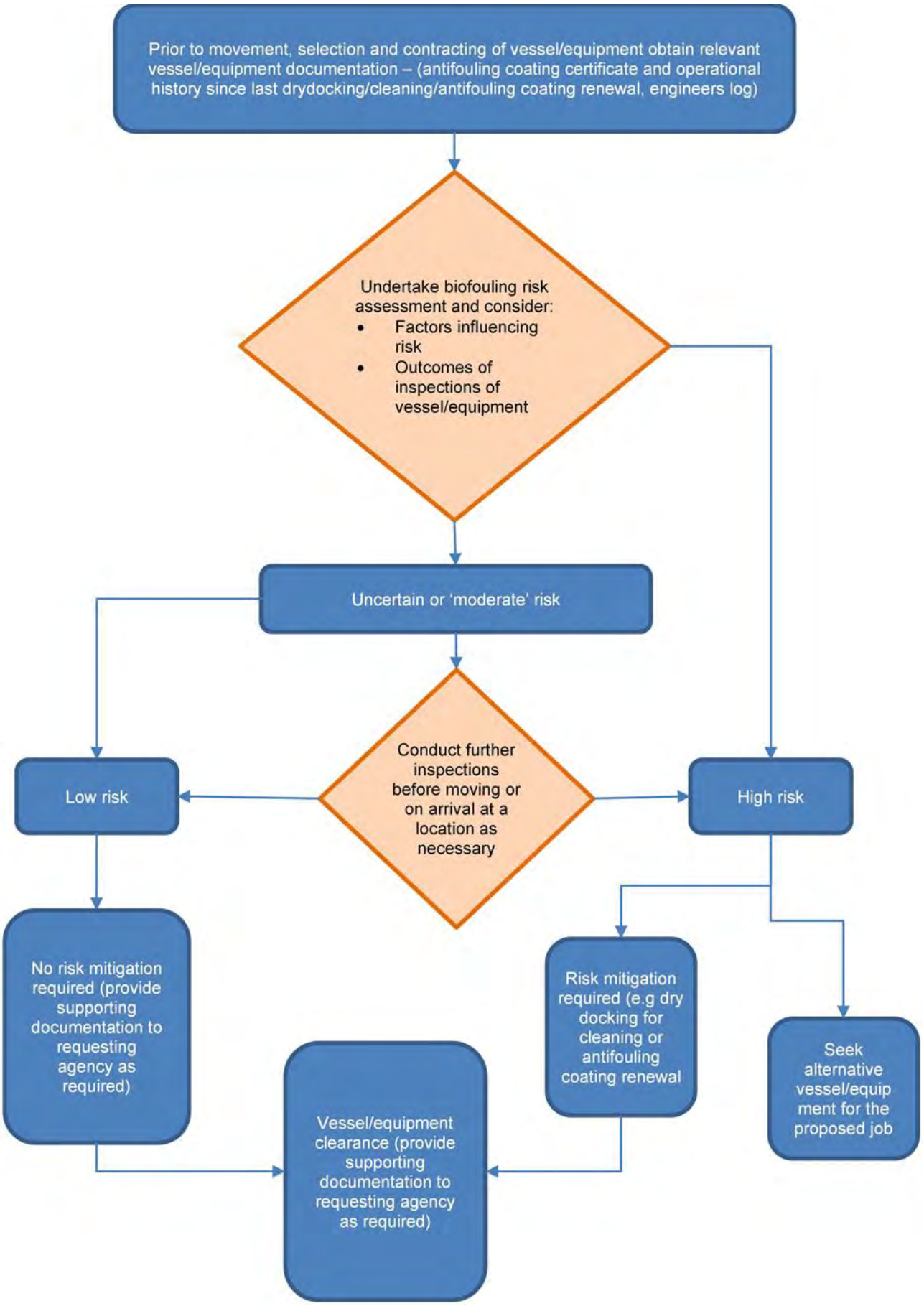
The outcome of the risk assessment will determine the management measures required. If the vessel is deemed as 'low' risk status, no other measures are required (providing the vessel does not exceed the 7-day threshold at stationary or slow speed, in waters outside Australia).

For vessels that are assessed as having an 'uncertain' or 'high' risk, contractors will engage a recognised and appropriately qualified IMS inspector to conduct inspections and/or provide advice on obtaining 'low' status. Table 8-4 lists mitigation measures that can be applied to achieve 'low' risk status.

Table 8-4: Biofouling mitigation measures

Mitigation measure	Overview
IMS inspection	Visual inspection of submerged surfaces and niche areas by a recognised and appropriately qualified biosecurity inspector to better understand the actual biosecurity risk.
In-water cleaning	The appropriateness of in-water cleaning operations must be a decision made closely with an IMS inspector on a case-by-case basis. Many factors will be considered, including: • degree and type of biofouling • location of biofouling on the vessel. Before undertaking in-water cleaning within Australia, approval from the relevant state/territory authority must be granted and conditions may be imposed. Application must be made to the administering authority (harbour master, local government or state/territory environmental protection agency) at least 5 working days before the proposed start of work.
Dry docking cleaning	Dry docking and cleaning to remove biofouling will include hull surfaces, niche areas such as sea chests, all retractable equipment such as thrusters, intakes and outlets, anodes and voids.
Temporal or spatial controls	Temporal or spatial controls to limit vessel exposure to sources of risk.

Mitigation measure	Overview
Applying anti fouling coating	Depending on its age, the vessel may require a new anti-fouling coating to be applied by professional operators. The anti-fouling coating type will be based on technical advice. All vessels more than 400 gross tonnage require a valid anti-fouling system certificate.
Treating internal sea water systems	In the absence of a marine growth prevention system, internal sea water systems may need to be cleaned. Cleaning actions may include: • dehydration • heat • physical removal • chemical treatment. Ideally, treating internal sea water systems will be undertaken before the vessel is mobilised to Australia. If chemical treatments are to be undertaken within Australian waters, advice must be sought from the Australian Pesticides and Veterinary Medical Authority (https://apvma.gov.au/) in relation to permit and reporting requirements—it is prohibited to clean internal systems in Australian waters without a permit.



Source: Marine Pest Sectoral Committee (2009)

Figure 8-1: Generic biofouling risk assessment process

8.6.6 Protocol for Protecting Underwater Cultural Heritage

Per condition 3 of EPBC Act approval of the DPD Project (EPBC 2022/09372), a Protocol for Protecting Underwater Cultural Heritage (PPUCH) has been developed by Santos to avoid and mitigate impacts on any underwater cultural heritage (UCH) in the environment of the Commonwealth marine area. As presented in Section 3.2.13.7 and 3.2.14.12, the results of UCH assessments have not identified any actual or potential UCH within the OA.

In the event that any items of underwater cultural heritage are identified during construction or any related activities impacting the seafloor, Santos has engaged suitably qualified underwater archaeologists and developed procedures and reporting to be implemented if UCH is discovered during construction. Procedures and reporting for both maritime and First Nations UCH are addressed below. If any underwater cultural heritage of clear archaeological character is identified by a suitably qualified underwater archaeologist, Santos will notify DCCEEW within 21 calendar days.

8.6.6.1 Maritime underwater cultural heritage unexpected finds protocol

In the unlikely event of an unexpected maritime UCH find, Santos will implement the UFP for maritime UCH (Attachment 1 of the PPUCH). The UFP was developed in consultation with appropriate specialists in the fields of archaeology (including maritime), who, under the UFP, are on-call for the duration of the Activity to assist with the identification and management of any unexpected maritime UCH.

The UFP for maritime UCH is summarised as follows:

- upon discovery of a potential archaeological object, the Santos Client Representative (SCR) is to be notified
- the SCR will then determine whether it is a possible heritage object or significant archaeological deposit using the Object Recognition Sheet
- if the object is assessed as a possible heritage object, work is to cease in the vicinity of the discovery of the object's find location and the project maritime archaeologist is to be immediately contacted, following the steps in Recording Methods and Procedures.
- cultural objects encountered on the sea floor, for example, during ROV survey, should be left and recorded in situ, unless they are under imminent threat of destruction. The guidelines for whether an object is to be retained for conservation or put back in the water near where it was found is presented in Artefact Collection and Curation Policies.

Stop work triggers and notification protocols are further described in Figure 8-2.

All Santos and contractor staff identified as relevant to implementation of this protocol, will complete an induction on the UFP for maritime underwater cultural heritage, and shall confirm by signature their understanding of the requirements.

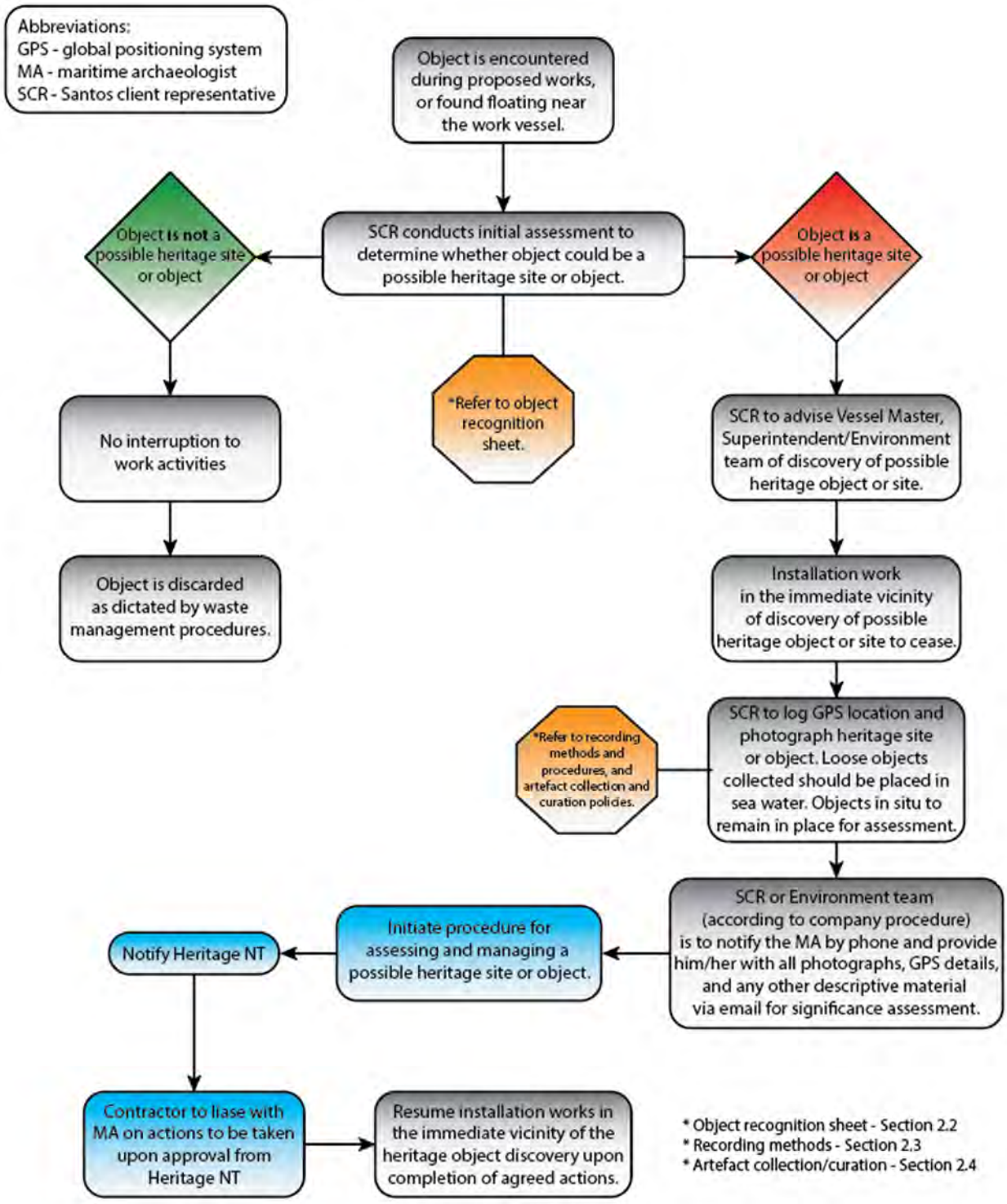


Figure 8-2: Stop work triggers and notification protocol for unexpected maritime find

8.6.6.2 First Nations underwater cultural heritage unexpected finds protocol

In the unlikely event of an unexpected First Nations UCH find, Santos will implement the UFP for First Nations underwater cultural heritage (Attachment 2 of the PPUCH). The UFP for First Nations cultural heritage was developed in consultation with appropriate specialists in the fields of archaeology (including First Nations and underwater archaeology), who, under the Protocol, are on-call for the duration of the Activity to assist with the identification and management of any unexpected First Nations UCH finds (including Macassan archaeological sites).

The UFP for First Nations cultural heritage has been divided into 2 phases based on the activity type and the ability to respond to unexpected finds, and is summarised as follows:

- Phase 1 (pre-trenching and pre-lay survey activities):

- Upon observing an object that the operatives believe could be a potential archaeological object ("an article that appears to be underwater cultural heritage"), the SCR is to be notified.
- The SCR will then use imagery available to determine whether the object is a possible First Nations object or significant archaeological deposit using the Object Recognition Sheet. If required, the SCR will involve the A to better enable an accurate determination of the what the object is. If the object is assessed as a likely cultural heritage object and it is likely to be impacted by the pipelay construction activities, a possible route deviation or sidestep within the prelay corridor will be assessed and the new route/lateral deviation shall be surveyed, if not yet covered. Given the limitations within Darwin Harbour, it is unlikely that re-routing in this section will be possible. Steps in the Recording Methods and Procedures should be followed. If rerouting the pipeline is not practical/possible then options to recover the likely cultural heritage object should be discussed and agreed as per the Artefact Collection and Curation Policies.
- If the object cannot be positively identified from the imagery available, further investigation of the object may be required if requested by the by the SCR and A. This may take the form of additional ROV deployment to obtain better quality imagery, to enable a positive identification. Steps in the Recording Methods and Procedures (Section 3.5) should be followed.

- Phase 2 (construction or pipelay activities):
  - Upon observing an object that the operatives, including the SCR, believe could be a potential archaeological object ("an article that appears to be underwater cultural heritage"), the SCR is to be notified. If required, the SCR will involve the A to better enable an accurate determination of the what the object is.
  - The SCR and A will then use available imagery to determine whether the object is a possible First Nations object or significant archaeological deposit using the Object Recognition Sheet (Figure 3-3) and their collective experience
  - If the object is assessed as:
    - Likely to be human remains, and these remains are located directly in the path of the pipeline, then works in the immediate area (within 10 m) must be halted pending the results of appropriate further investigation.
    - Likely to be a cultural heritage object that is directly in the path of the pipeline, then the following steps should be undertaken:
      - Log the GPS location and photograph the heritage site or object while in situ.
      - If the pipeline cannot be locally re-routed around the object in a timely manner, then attempt to recover, manage and assess the object for the cultural heritage and significance.
      - Once recovered, SCR, A, and First Nations representative to assess, confirm or not the identification of the object as cultural heritage and undertake a significance assessment for identified heritage.
    - Likely to be a cultural heritage object that is not directly in the path of the pipeline, then the following steps should be undertaken:
      - Log the GPS location and photograph the heritage site or object while in situ.
      - Leave object in situ.
  - Construction work may continue, although further actions may be requested by the SCR, Archaeologist and First Nations representative after a positive identification of the object as First Nations cultural heritage and the significance assessment results.
  - Construction work cannot be performed within 10 m of the potential cultural heritage object until approved by the SCR and Archaeologist, if the potential cultural heritage object is detected prior to work encroaching within this distance.

Figure 8-3 illustrates the response process upon encountering a potential unexpected First Nations cultural heritage find during Phase 1 (survey activities). Figure 8-4 illustrates the response process upon encountering a potential unexpected First Nations cultural heritage find during Phase 2 (construction or pipelay activities).

All Santos and contractor staff identified as relevant to implementation of this protocol, will complete an induction on the UFP for First Nations cultural heritage, and shall confirm by signature their understanding of the requirements.

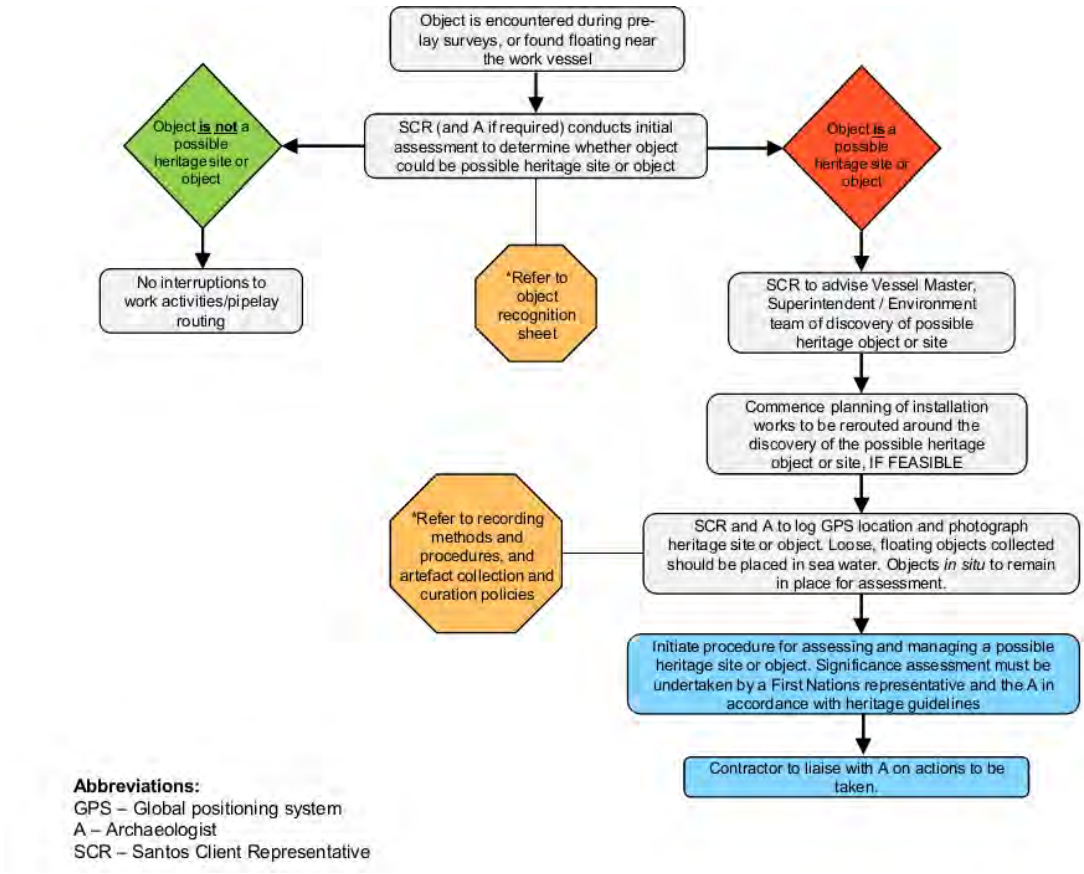


Figure 8-3: Phase 1 (during pre-trenching and pre-lay surveys) heritage response process upon encountering unexpected potential First Nations UCH

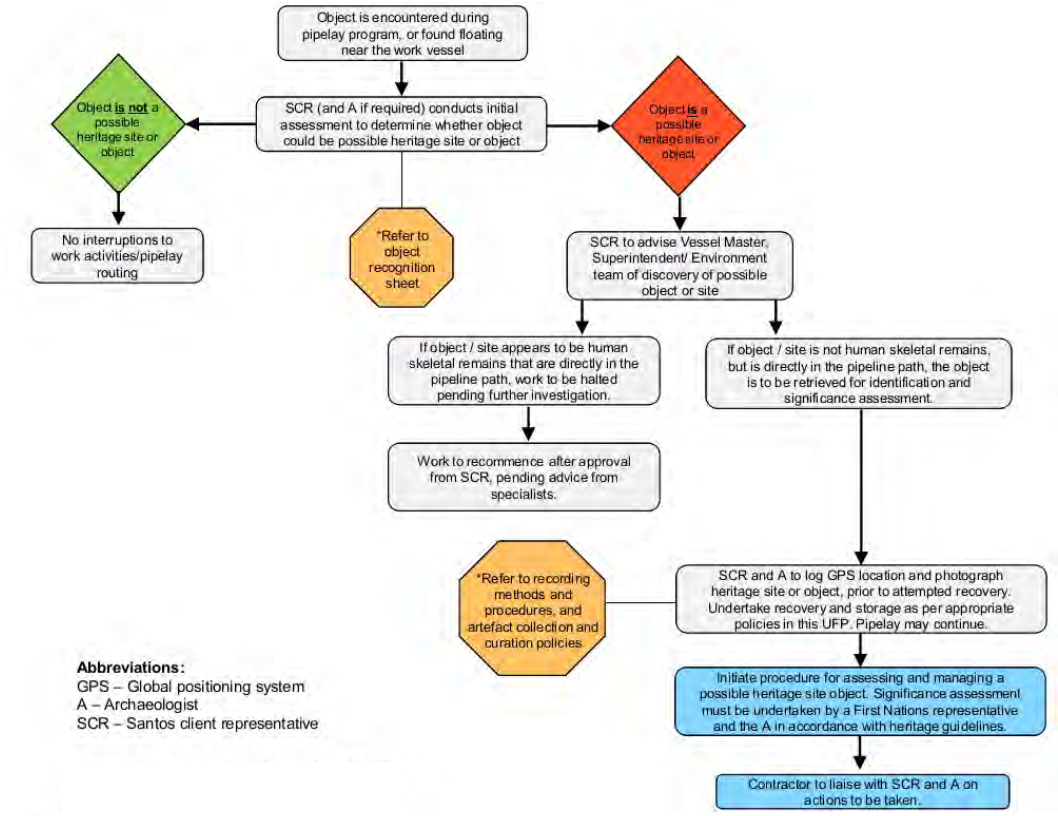


Figure 8-4: Phase 2 (during construction or pipelay activities) heritage response process upon encountering unexpected potential First Nations UCH

8.6.7 Systems, practices and procedures

All activities associated with the Activity are identified, planned and implemented in accordance with relevant legislation, EP commitments and Santos' environment standards and procedures. Processes are in place to verify that the controls and performance standards contained in this EP are being implemented to manage environmental impacts and risks associated with the maintenance activities to ALARP and to an acceptable level.

8.6.8 Health, safety and environmental management system interfaces

The pipelay and construction vessels will operate under their own safety case, which addresses generic aspects. The safety case revision documentation address project- and location-specific aspects, including the health, safety and environment management system interfaces between the contractor and Santos and any additional hazards/risks associated with specific operations of the Activity.

Santos and its contractor intend to have a clear demarcation of management system interfaces to ensure there will be no confusion between the roles and responsibilities of personnel, organisations, environmental management, procedures (e.g. such as the safety case) and/or reporting structure.

8.7 Incident reporting, investigation and follow-up

OPGGS(E)R 2023 Requirements
Section 24. Other information in environment plan
The environment plan must contain the following: (c) details of all reportable incidents in relation to the proposed activity.
Section 47. Notifying reportable incidents
(1) A titleholder commits an offence of strict liability if: a. the titleholder undertakes an activity under the title; and b. there is a reportable incident for the activity; and c. the titleholder does not notify NOPSEMA of the reportable incident in accordance with subsection (2). Penalty: 40 penalty units. (2) For the purposes of paragraph (1)(c), the notification: a. must be given as soon as practicable, and in any case not later than 2 hours, after: i. the first occurrence of the reportable incident; or ii. if the reportable incident was not detected by the titleholder at the time of the first occurrence—the time the titleholder becomes aware of the reportable incident; and b. must be oral; and c. must include: i. all material facts and circumstances concerning the reportable incident that the titleholder knows or is able, by reasonable search or enquiry, to find out; and ii. any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident; and iii. the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident. (3) As soon as practicable after the titleholder notifies a reportable incident, the titleholder must give a written record of the notification to: a. NOPSEMA; and b. the Titles Administrator; and c. if the incident occurred in the offshore area of a State—the Department of the responsible State Minister; and d. if the incident occurred in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister. (4) The titleholder is not required to include in the record anything that was not included in the notification.

Section 8.8.2 details the implementation strategy to maintain records of emissions and discharges, whether occurring during normal operations or otherwise (where practicable), in accordance with section 22(6) of the OPGGS(E)R. All personnel will be informed through inductions and daily operational meetings of their duty to report HSE incidents and hazards (including unplanned discharges and emissions). Reported HSE incidents and hazards will be shared during daily operational meetings and will be documented in the incident management systems as appropriate. HSE incidents will be investigated using root cause analysis.

Environmental recordable and reportable incidents will be reported to NOPSEMA as required, in accordance with Table 8-5. The incident reporting requirements will be provided to all crew on the facilities and vessels with special attention to the reporting timeframes to provide for accurate and timely reporting.

For the purposes of this activity, in accordance with section 5 of the OPGGS(E)R:

- a recordable incident, for an activity under this EP, means a breach of an EPO or EPS in this EP that is not a reportable incident
- a reportable incident, for an activity under this EP, means an incident relating to the Activity that has caused, or has the potential to cause, moderate to significant environmental damage.

For the purposes of this EP, a reportable incident is an incident that is assessed to have an environmental consequence of moderate or higher, in accordance with the Santos environmental impact and risk assessment process outlined in Section 5.

8.8 Reporting and notifications

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Monitoring and reporting (6) The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and environmental performance standards in the environment plan are being met. (7) The implementation strategy must state when the titleholder will report to NOPSEMA in relation to the titleholder's environmental performance for the activity. The interval between reports must not be more than 12 months. *Note: Section 51 requires a titleholder to report on environmental performance at the times or intervals set out in the environment plan.*
Section 24. Other information in environment plan
The environment plan must contain the following: c. details of all reportable incidents in relation to the proposed activity.
Section 47. Notifying reportable incidents
1) A titleholder commits an offence of strict liability if: a. the titleholder undertakes an activity under the title; and b. there is a reportable incident for the activity; and c. the titleholder does not notify NOPSEMA of the reportable incident in accordance with subsection (2). Penalty: 40 penalty units. (2) For the purposes of paragraph (1)(c), the notification: a. must be given as soon as practicable, and in any case not later than 2 hours, after: i. the first occurrence of the reportable incident; or ii. if the reportable incident was not detected by the titleholder at the time of the first occurrence—the time the titleholder becomes aware of the reportable incident; and b. must be oral; and c. must include: i. all material facts and circumstances concerning the reportable incident that the titleholder knows or is able, by reasonable search or enquiry, to find out; and ii. any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident; and iii. the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident. (3) As soon as practicable after the titleholder notifies a reportable incident, the titleholder must give a written record of the notification to: a. NOPSEMA; and b. the Titles Administrator; and c. if the incident occurred in the offshore area of a State—the Department of the responsible State Minister; and d. if the incident occurred in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister. (4) The titleholder is not required to include in the record anything that was not included in the notification.

8.8.1 Notifications and compliance reporting

Regulatory, other notification and compliance reporting requirements are summarised in Table 8-5.

Table 8-5: Activity notification and reporting requirements

Initiation	Required Information	Timing	Type	Recipient
Before the Activity				
AMSA/AHO (refer to Table 4-10)	Notification of proposed start and end dates and any other relevant information for the Notice to Mariners to be issued. AMSA's Joint Rescue Coordination Centre (JRCC) requires the: • vessel details (including name, callsign and maritime mobile service identity) • satellite communications details (including INMARSAT-C and satellite telephone numbers) • area of operation • requested clearance from other vessels • any other information that may contribute to safety at sea • when operations start and end.	At least 48 hours before vessel operations begin	Written	AMSA's JRCC rccaus@amsa.gov.au
		No less than 3 weeks before vessel operations begin	Written	AHO datacentre@hydro.gov.au Copied, for awareness, to: Office of the Regional Harbourmaster (NT-DIPL)
Quarterly updates	The Activity will be included in the Quarterly Update until the Activity has ended.	Quarterly	Online on Santos' website and automated notifications to registered/ subscribed interested parties	Relevant Persons and any other interested party who has registered or subscribed for quarterly updates.
DAFF (refer to Table 4-10)	Santos will: • pursuant to the *Biosecurity Act 2015* (Cth) and the Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016, undertake a vessel biosecurity risk and be assessed as 'low' by DAFF before interacting with domestic vessels and aircraft • undertake pre-arrival approval for vessels arriving from an international location (where applicable) using MARS to meet DAFF's biosecurity reporting obligations.	Where applicable, apply for biosecurity risk assessment at least one month before Activity begins. MARS reporting at least 12 hours before arrival of international vessels.	Written	DAFF Biosecurity (vessels, aircraft and personnel). https://www.agriculture.gov.au/biosecurity-trade/aircraft-vessels-military/vessels/mars
DAFF (Fisheries)	Prior notification of planned Activity commencement for the purpose of awareness of potential impacts to Commonwealth fishery licence holders.	No less than 4 weeks prior to the start of activities.	Written	DAFF
Department of Defence	Prior notification of planned Activity commencement, for the purposes of: • consideration of Defence activities • consideration of restricted airspace.	No less than 5 weeks prior to the start of activities.	Written	Department of Defence
Department of Primary Industries and Regional Development (DPIRD)	Prior notification of planned Activity commencement for the purpose of awareness of potential impacts to WA State fishery licence holders.	No less than 4 weeks prior to the start of activities.	Written	DPIRD
Western Australian Fishing Industry Council (WAFIC)	Prior notification of planned Activity commencement for the purpose of awareness of potential impacts to WA State fishery licence holders.	No less than 4 weeks prior to the start of activities.	Written	WAFIC
Marine user notifications to Relevant Persons identified in Table 8-6 (as may be updated from time to time).	Prior notification to OA marine users of planned Activity commencement.	At least 10 days before the Activity begins	Written	As indicated in Table 8-6 by email.
Tiwi Islands clan groups	Prior notification of planned Activity commencement.	At least 10 days before the Activity begins	Written	Tiwi Resources (on behalf of Tiwi Islands clan groups). Tiwi Resources will notify clan group representatives.
Other First Nations Groups, as agreed through the post acceptance consultation implementation process, and through the NLC	Prior notification of planned Activity commencement.	At least 10 days before the Activity begins	Written	As determined through the post acceptance consultation implementation process.
OPGGS(E)R 54 – Notifications NOPSEMA must be given written notice that the activity is to begin	Complete NOPSEMA's Section 54 Start or End of Activity Notification form before the Activity[52].	At least 10 days before the Activity begins.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions
During the Activity				
OPGGS(E)R 50 – Recordable Incidents	Complete NOPSEMA's Recordable Environmental Incident Monthly Report form[52].	As soon as practicable after the end of the calendar month, and in any case, not later	Written	NOPSEMA

[52] *https://www.nopsema.gov.au/document-hub/forms-and-templates*

Initiation	Required Information	Timing	Type	Recipient
NOPSEMA must be notified of a breach of an EPO or EPS, in the environment plan that applies to the activity that is not a reportable incident.		than 15 days after the end of the calendar month.		https://securefile.nopsema.gov.au/filedrop/submissions
OPGGS(E)R 24(c), 47 & 48 – Reportable Incident NOPSEMA, NOPTA and Department of the responsible State Minister or NT Minister must be notified of any reportable incidents A reportable incident is defined as per Section 8.6.	The oral notification must contain: • all material facts and circumstances concerning the reportable incident known or that could be found out by reasonable search or enquiry • any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.	As soon as practicable, and in any case not later than 2 hours after the first occurrence of a reportable incident, or if the incident was not detected at the time of the first occurrence, at the time of becoming aware of the reportable incident.	Oral	NOPSEMA 1300 674 472
	A written record of the oral notification must be submitted. The written record is not required to include anything that was not included in the oral notification.	As soon as practicable after the oral notification.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions National Offshore Petroleum Titles Administrator (NOPTA) reporting@nopta.gov.au Department of the responsible State or NT Minister
	A written report must contain: • all material facts and circumstances concerning the reportable incident known or that could be found out by reasonable search or enquiry • any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident • the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future Report using NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form[52].	Must be submitted as soon as practicable, and in any case not later than 3 days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise. Same report to be submitted to NOPTA and the Department of the responsible State or NT Minister within 7 days after giving the written report to NOPSEMA.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions NOPTA reporting@nopta.gov.au Department of the responsible State or NT Minister
OPGGS(E)R 22(7) & 51 – Environmental Performance NOPSEMA must be notified of the environmental performance at the intervals provided for in the EP	Report must contain sufficient information to determine whether or not EPO and EPS in the EP have been met. Report will also address progress of Santos' identification and/or implementation of sea country initiatives.	An environmental performance report will be submitted to NOPSEMA annually from the date of acceptance of this EP.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions
AMSA Reporting	Titleholder agrees to notify AMSA of any marine pollution incident[53].	Notification within 2 hours of incident.	Oral	AMSA JRCC 1800 641 792
	Harmful Substances Report[54] and situation report (SITREP) available online (refer OPEP [BAS-210 0131]).	Harmful Substances Report as requested by AMSA following verbal notification.	Written	AMSA JRCC rccaus@amsa.gov.au
DBCA-WA Reporting Notification in the event of a hydrocarbon release	Verbal notification of any hydrocarbon release.	Verbal notification as soon as reasonably practicable.	Oral	DBCA-WA Kimberley regional office
DNP Reporting Notification of the event of oil pollution within a marine park or where an oil spill response action must be taken within a marine park (requested through consultation)	The DNP should be made aware of oil/gas pollution events that occur within a marine park or are likely to impact a marine park as soon as possible. Notification should be provided to the 24-hour Marine Compliance Duty Officer. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be affected) • proposed response arrangements as per the OPEP (BAS-210 0131) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.	As soon as reasonably practicable.	Oral	DNP (Marine Park Compliance Duty Officer)

[53] For clarity and consistency across Santos regulatory reporting requirements Santos will meet the requirement of reporting marine oil pollution by reporting oil spills assessed to have an environmental consequence of moderate or higher in accordance with Santos' environmental impact and risk assessment process outlined in Section 5.

[54] https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil

Initiation	Required Information	Timing	Type	Recipient
	Note: The DNP may request daily or weekly situation reports, depending on the scale and severity of the pollution incident.			
DCCEEW Reporting • Any harm or mortality to EPBC Act listed threatened marine fauna • Discovery of underwater cultural heritage	Notification of any harm or mortality to an EPBC Act listed species of marine fauna whether attributable to the Activity or not.	Email notification within 7 days.	Written	DCCEEW EPBC.permits@environment.gov.au
	If MNES are considered at risk from a spill or response strategy, or where there is death or injury to a protected species.	Email notification as soon as practicable.	Written	DCCEEW (Director of Monitoring and Audit section)
	Underwater cultural heritage details recorded in online database if discovered during activity and notified to DCCEEW.	As soon as practicable, in any case no later than 21 days after discovery.	Written	DCCEEW
Australian Marine Mammal Centre Reporting (DCCEEW) Any ship strike incident with cetaceans will be reported to the National Ship Strike database	Ship strike report provided to the Australian Marine Mammal Centre: https://data.marinemammals.gov.au/report/shipstrike.	As soon as practicable.	Written	DCCEEW
NT DEPWS **EPA (NT)** All actual or impending spills in NT waters	Verbal reporting will transfer sufficient information to conduct a coordinated emergency response. All reporting will be performed by the vessel master as per the vessel specific SOPEP.	As soon as practicable.	Oral	DEPWS; EPA (NT) (Pollution response hotline; Environmental Operations)
	Written reports will contain all material facts and circumstances concerning the reportable incident, actions taken to avoid or mitigate any adverse impacts, and corrective action taken.	Written report as soon as practicable.	Written	DEPWS; EPA (NT) (Pollution response hotline; Environmental Operations)
AFMA	Verbal notification if any spill may affect Commonwealth-managed fisheries within the EMBA.	Verbal notification within 8 hours.	Verbal	AFMA
Department of Foreign Affairs and Trade (DFAT)	Any oil spill that has entered or is likely to enter international waters.	Verbal phone call notification within 8 hours, if the spill is likely to extend into international waters.	Verbal	DFAT (24-hour consular emergency centre)
		Follow up with email outlining details of incident.	Written	DFAT (24-hour consular emergency centre)
Consultation with AMSA (refer to Table 4-10)	Notification of updates to both AHO and JRCC on progress and, importantly, any changes to the intended operations.	As soon as possible.	Written	AMSA's JRCC AHO
Tiwi Resources (Ranger Coordinator), Tiwi Land Council and Munupi Clan members.	Notification of all spills heading towards the Tiwi Islands.	Within 8 hours of incident being identified	Oral – by phone call	Tiwi Resources (Ranger Coordinator), Tiwi Land Council and nominated Munupi Clan members (per Table 7-1 from OPEP [BAS-210 0131]), subject to obtaining relevant email addresses.
	Follow up email notification outlining details of incident.	After oral notification.	Written	
Other First Nations Groups, as agreed through the post acceptance consultation implementation process and through the NLC.	Notification of all spills heading towards the relevant parties' interests.	Within 8 hours of incident being identified.	Oral – by phone call	As determined through the post acceptance consultation implementation process.
	Follow up email notification outlining details of incident.	After oral notification.	Written	As determined through the post acceptance consultation implementation process.
End of the Activity				
OPGGS(E)R 54 – Notifications NOPSEMA must be given written notice that the activity has ended.	Complete NOPSEMA's Section 54 Start or End of Activity Notification form[52].	Within 10 days after completion of the Activity.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions
OPGGS(E)R 46 – EP ends when titleholder notifies completion and the Regulator accepts the notification NOPSEMA must be notified that the Activity has ended and all EP obligations have been completed.	Complete NOPSEMA's Regulation 46 – End of Operation of Environment Plan form[52].	At the completion of the Activity and all EP obligations.	Written	NOPSEMA https://securefile.nopsema.gov.au/filedrop/submissions
AMSA (JRCC) consultation	Notification that activity has completed.	Within 10 days of completion.	Written	JRCC
AHO	Notification that activity has completed.	Within 10 days of completion.	Written	AHO
DAFF	Notification that Activity has completed.	Within 10 days of completion.	Written	DAFF
DoD	Notification that Activity has completed.	Within 10 days of completion.	Written	DoD
DPIRD	Notification that Activity has completed.	Within 10 days of completion.	Written	DPIRD
WAFIC	Notification that Activity has completed.	Within 10 days of completion.	Written	WAFIC
Marine user notifications to Relevant Persons identified as in Table 8-6 (as may be updated from time to time).	Notification to the OA marine users that the Activity has completed.	Within 10 days of completion.	Written	As indicated in Table 8-6 by email.

Initiation	Required Information	Timing	Type	Recipient
Tiwi Islands clan groups	Notification that Activity has completed.	Within 10 days of completion.	Written	Tiwi Resources (on behalf of Tiwi Islands clan groups). Tiwi Resources will notify clan group representatives.
Other First Nations Groups, as agreed through the post acceptance consultation implementation process and through the NLC.	Notification that Activity has completed.	Within 10 days of completion.	Written	As determined through the post acceptance consultation implementation process.

Table 8-6: Marine user notification recipients

Person to be issued marine user notifications	Notification Recipient
Aquarium Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Australian Border Force (ABF)	ABF
Australian Fisheries Management Authority (AFMA)	AFMA
Australian Institute of Marine Science (AIMS)	AIMS
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA
Demersal Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Department of Defence – Navy (DoD – Navy)	DoD – Navy
Eni Australia Ltd	Eni Australia Ltd
INPEX Ichthys Pty Ltd	INPEX Ichthys Pty Ltd
Northern Prawn Fishery commercial licence-holders	NPFI
Northern Prawn Fishing Industry Pty Ltd (NPFI)	NPFI
NT Department of Industry, Tourism & Trade - Fisheries (NTDITT – Energy Division)	NTDITT - Energy
NT Department of Industry, Tourism & Trade - Fisheries (NTDITT – Fisheries Division)	NTDITT - Fisheries
NT Guided Fishing Industry Association	NT Guided Fishing Industry Association
NT Seafood Council (NTSC)	NTSC
NT Timor Reef Fishery commercial licence holders	NTSC
Offshore Net and Line Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Pearl Oyster Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Small Pelagic (Development) Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Southern Bluefin Tuna Fishery licence-holders	ASBTIA and AFMA
Spanish Mackerel Fishery licence-holders	NTSC and NTDITT – Fisheries Division
Top End Tourism	Top End Tourism
Tourism NT	Tourism NT
Western Skipjack Tuna Fishery licence-holders	ASBTIA and AFMA
Western Tuna and Billfish Fishery licence-holders	ASBTIA and AFMA
Woodside Energy Ltd	Woodside Energy Ltd

8.8.2 Monitoring and recording emissions and discharges

OPGGS(E)R 2023 Requirements
Section 34. Criteria for acceptance of environment plan
For the purposes of section 33, the criteria for acceptance of an environment plan (the environment plan acceptance criteria) for an activity are that the plan: e. includes an appropriate implementation strategy and monitoring, recording and reporting arrangements.
Section 22. Implementation strategy for environment plan
Monitoring and reporting (6) The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the environment plan are being met.

Discharges to the marine environment associated with this activity will be recorded and controlled in accordance with requirements under relevant Marine Orders and/or MARPOL requirements.

Santos and vessel contractors will maintain records so that emissions and discharges can be determined or estimated. Such records will be maintained for 5 years. Contractors must make these records available upon request.

In addition, Santos will maintain records of discharges or emissions (where practicable), to the environment as described in Table 8-7.

Table 8-7: Monitoring of emissions and discharges

Discharge/emission	Parameter	Quantitative record
Pre-commissioning fluids	Volumes consumed	Volumes used will be estimated based on known inventories
Air emissions	Fuel volume	GHG calculations based on measured fuel use in accordance with NGER reporting requirements
Ballast water	Volume and location	Ballast water log
Garbage (including food scraps)	Volume and location	Volumes recorded in Garbage Record Book*
Sewage	Volume and location	Estimated based on POB and days on location
Unplanned discharge of: • solid objects • hazardous liquids	Volume	NOPSEMA recordable or reportable incident reports as per Table 8-5
Unplanned hydrocarbon release	Volume	NOPSEMA recordable or reportable incident reports as per Table 8-5

8.9 Document management

8.9.1 Information management and document control

This EP and OPEP (BAS-210 0131), as well as approved MoC documents, are controlled documents and current versions will be available on Santos' intranet. Santos contractors are required to maintain current versions of these documents.

EPOs and EPSs will be measured based on the measurement criteria listed in Table 8-2. Such records will be maintained for 5 years. Contractors must make these records available upon request.

8.9.2 Management of change

The MoC process (EA-91-IQ-10001) provides a systematic approach to initiate, assess, approve, implement and close out actions associated with a change in the Activity. Implementation of the MoC process is designed so that all activities undertaken by Santos are in full compliance with regulatory approvals and conditions and that changes have been properly considered, risk assessed, approved and communicated to all appropriate stakeholders accompanied by a detailed record of the change in Activity.

The MoC process considers sections 18, 19 and 39 of the OPGGS(E)R 2023 and determines if a proposed change can proceed and the manner in which it can proceed. The MoC procedure will determine whether a revision of the EP is required and whether that revision must be submitted to NOPSEMA. Additional consultation with Relevant Persons may be appropriate in order to complete the MoC process, depending on the nature and scale of the change.

The MoC procedure also allows for the assessment of information that may become available after EP acceptance. When further feedback is received from external stakeholders after EP acceptance, consideration will be given as to whether it includes information concerning the environmental impacts or risks of Santos' activities, and if so, whether these impacts or risks were provided for in the relevant approval documentation (e.g. in this EP). If not provided for, the MoC process will be initiated in a timely manner in order for the significance of the new information, and any new or increased impacts or risks to be assessed.

Accepted MoCs become part of the in-force EP or OPEP, are tracked on a register and are made available on Santos' intranet. Where appropriate, the EP compliance register will be updated so that CM or EPS changes are communicated to the workforce and implemented. Any MoC will be distributed to the relevant roles identified in Table 8-3, and the most relevant management position is responsible for communication and implementation of the MoC. This may include crew meetings, briefings or communications as appropriate for the change.

8.9.3 Reviews

This EP has assessed impacts and risk across the entire OA, during any time of the year, for planned and unplanned events given the nature of the 24/7 operations and the length of time for which the Activity will continue.

It is recognised that during the period for which this EP is in force, the following may change:

- legislation
- businesses conditions, activities, systems, processes and people
- industry practices
- science and technology
- societal and relevant and interested persons' expectations.

The following tasks are undertaken so that Santos maintains up-to-date knowledge of the industry, legislation and conservation advice:

- maintain membership of Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association) which provides a mechanism for communicating potential changes in legislation, industry practice and other issues that may affect EP implementation to Relevant Personnel in Santos
- undertake annual spill response exercises to check spill response arrangements and capability are adequate
- undertake appropriate post acceptance implementation consultation with relevant authorities and relevant interested persons or organisations as outlined in Section 8.11
- subscribe to various regulator updates
- have regular liaison meetings with NOPSEMA.

If identified changes have an impact on the Activity or risks described and assessed in this EP that may trigger a requirement under sections 18, 19 or 39 of the OPGGS(E)R, the changes will be reviewed and any changes required to the EP are to be assessed and documented in accordance with Santos' MoC procedure (Section 8.9.2).

8.10 Audits and inspections

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Monitoring and reporting (5) The implementation strategy must provide for sufficient monitoring, recording, audit, management of nonconformance and review of the titleholder's environmental performance and the implementation strategy to ensure that the environmental performance outcomes and standards in the environment plan are being met.

8.10.1 Assurance and audits

Santos maintains a risk based activity assurance and audit schedule which is reviewed and updated from time to time.

Assurance activities and audits will be undertaken in a manner consistent with Santos' Assurance Operating Standard (SMS-LRG-OS03) and the Barossa Project Environmental Compliance Assurance Plan (BAA-200 0635).

During the Activity, an assurance review against the EP and/or OPEP will be performed at least annually, and may be desktop only or include a field-based component.

Assurance and audit findings may include opportunities for improvement and non-conformances. Audit non-conformances are managed as described in Section 8.10.3.

8.10.2 Inspections

HSE inspections will be conducted at the following frequency to identify hazards, incidents and nonconformances with this EP:

- pipelay and construction vessels – minimum weekly
- support and supply vessels – minimum monthly

These inspections will also check compliance against a selection of the EPOs and EPSs of this EP (Table 8-2) and inform end-of-activity reporting (Table 8-5).

8.10.3 Nonconformance management

EP non-compliances will be addressed and resolved by a systematic corrective action process as outlined in Santos' Compliance Operating Standard (SMS-LRG-OS04). Non-compliances arising from audits and inspections will be entered into Santos' incident and action tracking management system (i.e. HSE Toolbox). Once entered, corrective actions, time frames and responsible persons (including action owners and event validators) will be assigned. Corrective action 'close out' will be monitored using a management escalation process.

8.10.4 Continuous improvement

For this EP, continuous improvement will be driven by:

- improvements identified from the review of business-level HSE key performance indicators
- actions arising from Santos and departmental HSE improvement plans
- corrective actions and feedback from HSE audits and inspections, incident investigations and after-action reviews
- opportunities for improvement and changes identified during pre-activity reviews and MoC documents
- actions taken to address objections or claims, and issues raised during the post acceptance consultation implementation process (Section 8.11).

This may result in a review of the EP, with changes applied in accordance with Section 8.9.2.

Identified continuous improvement opportunities will be assessed in accordance with the MoC process so that any potential changes to this EP or OPEP (BAS-210 0131) are managed in accordance with the OPGGS(E)R and in a controlled manner.

8.11 Post acceptance consultation implementation strategy

OPGGS(E)R 2023 Requirements
Section 22. Implementation strategy for environment plan
Consultation and compliance (15) The implementation strategy must provide for appropriate consultation with: a. relevant authorities of the Commonwealth, a State or Territory; and b. other relevant interested persons or organisations.

Post-acceptance consultation activities for this EP will be principally supported by Santos' existing regional relationships with those organisations whose functions, interests and activities may be affected by the Activity.

Santos recognises and respects the preference of relevant government authorities and other relevant interested persons and organisations to determine the frequency and method of updates, in addition to the written quarterly updates outlined in this strategy below.

8.11.1 First Nations people and groups

Santos will undertake consultation over the life of the Activity with First Nations representative organisations.

Santos will provide quarterly written activity updates via land councils and Aboriginal Corporations, specifically to:

- GDA
- KLC
- LNAC
- LDC
- NLC
- TLC
- Wickham Point Deed liaison committee
- Quarterly written Activity updates will also be provided to:
    - Tiwi Clan Trustees for each Clan via TLC
    - First Nations Consultative Committees via Committee Chairs

Having regard to Santos' experience consulting with First Nations groups, and feedback from First Nations Relevant Persons, Santos considers that consultation through representative bodies provides an appropriate mechanism for ongoing consultation with First Nations relevant interested persons.

Representative bodies provide for regular, culturally appropriate engagement, including processes for dissemination of information to First Nations Elders, cultural leaders and communities in a manner that is readily accessible and culturally appropriate.

8.11.2 Local governments, communities and industry

As part of Santos' community engagement efforts for the broader Barossa Gas Project, Santos will provide quarterly written activity updates to regional local government and associated communities.

Santos will also provide quarterly written activity updates to the commercial fishing industry, which is the industry most likely to be affected by proposed activities. Santos will provide quarterly written activity updates to those representative organisations whose membership are most likely to be affected, specifically to NPFI.

8.11.3 Post-acceptance consultation implementation strategy – approach

Santos will provide to those organisations identified above quarterly written updates on the Activity covered by this EP. The updates will also be posted on Santos' website, with notifications to registered/subscribed interested parties.

Activity notifications and reports will be made in accordance with Table 8-5. The notifications and reports are based on legislative requirements, standing arrangements with particular Relevant Persons, Relevant Persons' requests for notification made during OPGGS(E)R section 25 consultation or as otherwise deemed appropriate by Santos.

Santos will apply the regional engagement model to consider the preferences of relevant government authorities and other relevant interested persons and organisations when determining the frequency and method of additional updates.

A community lead for each region (e.g. NT Community Affairs Manager) oversees the development and implementation of engagement related plans, such as community investment plan and provision of information updates on Santos activities. A core aim is to build long term relationships with key local stakeholders through regular engagement.

The regional engagement model is bespoke for each area so it can incorporate the preferences of local stakeholders. For example, the NT model includes the use of a Darwin shopfront which is open to the public and a NT based First Nations Engagement Adviser. These plans also consider the community commitments (e.g. post EP engagement) for each region. For example, the NT model includes quarterly meetings with Larrakia people through the Wickham Point Deed liaison committee.

Santos will continue to accept, assess and respond to post-acceptance consultation feedback during the life of the Activity. Records of any post-acceptance consultation will be maintained in an appropriate Santos consultation database.

If, during the course of post acceptance consultation, Santos receives information demonstrating a new or increased environmental impact or risk that is not provided for in this EP, as in force at the time, Santos will apply its MoC process outlined in Section 8.9.2.

Santos will maintain a database of relevant authorities, and other relevant interested persons and organisations for this Activity. This includes updating its database in light of post acceptance consultation, including identification of new Relevant Persons.

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Title	Document No.
Assurance Operating Standard	SMS-LRG-OS03
Assurance Procedure	SMS-LRG-OS03-PD01
DPD Installation in Commonwealth Waters Oil Pollution Emergency Plan	BAS-210 0131
Environment Management of Change Procedure	EA-91-IQ-10001
HSE Contractor Management Operating Standard	SMS-HSS-OS08
Marine Operations Manual	IOSC/OPS/HBK/0003
Offshore Division Environmental Hazard Identification and Assessment Guideline	EA-91-IG-00004
Offshore Marine Assurance Procedure	SO-91-ZH-10001
Protected Marine Fauna Interaction and Sighting Procedure	EA-91-II-00003
Protocol for Protecting Underwater Cultural Heritage	BAS-210 0265
Risk Management Policy	QE-91-IF-10050
Risk Management Procedure	SMS-MS1-ST01-TP1
Risk Management Standard	SMS-MS1
Wildlife Framework Plan	SO-91-BI-20014

Appendix A Santos' environment, health and safety policy

Environment, Health & Safety

Santos

Policy

Our Commitment

Santos is committed to being the safest gas company wherever we have a presence and preventing harm to people and the environment

Our Actions

We will:

1. Integrate environment, health and safety management requirements into the way we work
2. Comply with all relevant environmental, health and safety laws and continuously improve our management systems
3. Include environmental, health and safety considerations in business planning, decision making and asset management processes
4. Identify, control and monitor risks that have the potential for harm to people and the environment, so far as is reasonably practicable
5. Report, investigate and learn from our incidents
6. Consult and communicate with, and promote the participation of all workers to maintain a strong environment, health and safety culture
7. Empower our people, regardless of position, to "Stop the Job" when they feel it necessary to prevent harm to themselves, others or the environment
8. Work proactively and collaboratively with our stakeholders and the communities in which we operate
9. Set, measure, review and monitor objectives and targets to demonstrate proactive processes are in place to reduce the risk of harm to people and the environment
10. Report publicly on our environmental, health and safety performance

Governance

The Environment Health Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

Managing Director & CEO

Status: APPROVED

Document Owner:	David Banks, Chief Operating Officer		
Approved by:	The Board	Version:	3

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Appendix B Requirements (including legislative requirements) applicable to the Activity

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
Commonwealth				
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth) (ATSIHP Act)	This Act provides for the preservation and protection from injury or desecration areas and objects in Australia and Australian waters that are of significance to Aboriginal people in accordance with Aboriginal tradition. The Minister may make a declaration to protect such areas and objects. The Act also requires the discovery of Aboriginal remains to be reported to the Minister.	No – the ATSIHP Act is not directly relevant to the environmental management of the Activity as there are no areas within the OA or the EMBA that have been the subject of a 'significant Aboriginal areas' declaration under the ATSIHP Act. However, in the event such areas are declared in the future, this Act could potentially become relevant to the activities. Accordingly, this Act has been identified for completeness. For completeness Santos notes that on 23 October 2023 it was informed by the DCCEEW that applications had been received under the ATSIHP Act in relation to certain areas of the sea. Santos understands that these areas are at least 200 km from the OA but overlap a small portion of the outer limits of the EMBA. Santos understands that no decisions have been made by the Minister in relation to the applications at the time of writing.	Commonwealth – Attorney-General's Department DCCEEW	There are no requirements arising under the ATSIHP Act that apply to the environmental management of the Activity. Refer to Sections 3.2.13.7 and 3.2.14 in relation to relevant heritage values and cultural features more broadly.
Aboriginal Land Rights (Northern Territory) Act 1976 (Cth) (ALR Act)	This Act provides for the granting of Traditional Aboriginal Land in the NT for the benefit of Aboriginals, and for other purposes. Establishes Land Councils and enables them to operate.	No – the ALR Act is not directly relevant to environmental management of the Activity. There are no predicted impacts to land or nearshore locations (including the Tiwi Islands) associated with the Activity. However, the TLC which is established under the ALR Act, represents Tiwi people in the protection of land, sea and environment. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the TLC and Tiwi people in the course of preparing this environment plan).	Commonwealth – Attorney-General's Department Commonwealth – Department of the Prime Minister and Cabinet Tiwi Land Council (TLC)	There are no requirements arising under the ALR Act that apply to the environmental management of the Activity. Refer to Sections 3.2.13.7 and 3.2.14 in relation to relevant heritage values and cultural features more broadly. Refer also to Section 4 in relation to consultation with

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
				the TLC and Tiwi people.
Australian Maritime Safety Authority Act 1990 (Cth) (AMSA Act)	This Act establishes the Australian Maritime Safety Authority (AMSA), which manages the National Plan for Maritime Environmental Emergencies in coordination with industry. AMSA is also responsible for administering Marine Orders in Commonwealth waters. The Act also aims to promote maritime safety, protect the marine environment from pollution and environmental damage from ships, provide for a national search and rescue service and promote the efficient provision of service by AMSA. AMSA is the lead agency for responding to oil spills in the marine environment and is responsible for the Australian National Plan for Maritime Environmental Emergencies.	Yes – while the Act does not contain any explicit requirements relevant to the environmental management of the Activity, it establishes and sets out the functions of AMSA, which functions relate to environmental management including in respect of response to spill events and administration of marine orders.	AMSA Commonwealth – Department of Infrastructure, Transport, Regional Development, Communications and the Arts	AMSA has been consulted as a Relevant Person – refer to Section 4 in preparing the EP, and will be notified throughout activities in accordance with Table 8-5. AMSA's relevant functions are described in Section 7.6.
Biosecurity Act 2015 (Cth) Biosecurity Regulation 2016 (Cth) Australian Ballast Water Management Requirements, Version 8	This Act relates to the management of diseases and pests that may cause harm to human, animal or plant health or the environment. This Act includes provisions for ballast water management plans and certificates, record keeping obligations and powers to ensure compliance. This Act includes mandatory controls on the use of seawater as ballast in ships and the declaration of sea vessels voyaging out of and into Commonwealth waters. The Regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the quarantine officers. Australian Ballast Water Management Requirements outline the mandatory ballast water management requirements to reduce the risk of introducing invasive marine species (IMS) into Australia's marine environment through ballast water from international vessels. These requirements are enforceable under the *Biosecurity Act 2015* (Cth) and include obligations under the International Convention for the Control and Management of Ships' Ballast Water and Sediments.	Yes – this Act and Regulations apply to all foreign vessels operating in Australian waters and these vessels must comply with the Australian Ballast Water Management Requirements.	DAFF	Refer to Sections 7.2 and 8 which contains control measures in respect of the implementation of the Australian Ballast Water Management Requirements 2017.
Climate Change Act 2022 (Cth) (Climate Act)	The Climate Act and the Consequential Amendments Act commenced in September 2022. The Climate Act and Consequential Amendments Act sets out Australia's net-zero commitments and codifies	While the oil and gas sector is not subject to direct obligations under these Acts, these Acts legislate Australia's emissions net zero targets by 2050. The Santos Climate Change Policy and target to become a net-zero scope 1 and 2 GHG emissions	Climate Change Authority	Refer to Section 6.5 which refers to Santos' Climate Change Policy.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
	Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement.	by 2040 are aligned with these Acts. The activities covered under this EP are consistent with the principles of ESD and ALARP to mitigate GHG emissions.		
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) Environment Protection and Biodiversity Conservation Regulations 2000 (Cth)	While the OPGGS(E)R under the OPGGS Act (see below) regulate day to day petroleum activities and apply to any activity that may have an impact on the environment, the EPBC Act regulates the assessment and approval of proposed actions that are likely to have a significant impact on a matter of National Environmental Significance (MNES). Actions that are likely to have a significant impact on a MNES require referral under the EPBC Act; the assessment process is administered by the Department of Climate Change, Energy, the Environment and Water. Schedule 8 of the EPBC Regulations outlines the Australian IUCN Reserve Management Principles. Further, the Regulations provide for the protection and conservation of cetaceans, and create various offences for actions that may endanger them.	Yes – the EPBC Act applies to all aspects of the Activity that have the potential to impact MNES, and the Regulations contain requirements regarding interactions with cetaceans. On 15 March 2024, the DPD Project (in Commonwealth and NT waters) was conditionally approved under the EPBC Act approval (2022/09372). Relevant conditions for this EP include the development of a PPUCH to avoid and mitigate impacts to maritime and First Nations UCH in the Commonwealth marine area (refer to C6.2.9 and C6.2.11).	DCCEEW NOPSEMA	The DPD Project was conditionally approved under the EPBC Act (2022/09372). Refer to Table 8-2 (C6.2.9 and C6.2.11) and Section 8.6.6 for protocols to manage UCH. Refer to Sections 3.2 – Environmental Values and Sensitivities as well as Sections 6 and 7 – Planned impacts and unplanned events for treatment of MNES. Appendix C
Fisheries Management Act 1991 (Cth)	Management plans for fisheries are established under this Act, and this Act also sets out the legislative basis for Statutory Fishing Rights (SFRs), licences and permits. This Act defines the Australian Fishing Zone (AFZ) and provides for the majority of Commonwealth fisheries offences. This Act also establishes the functions of the AMFA, including in relation to the pursuit of ecologically sustainable development.	No – this Act is not directly relevant to the environmental management of the Activity. However, in the event of a spill, this Act provides the regulatory framework for any necessary fisheries management decisions in Commonwealth waters. Further, the AFMA is responsible for managing Commonwealth fisheries and is a relevant agency where the Activity has the potential to impact on fisheries resources in AFMA managed fisheries. The OA and EMBA overlaps four Commonwealth commercial fisheries managed by the AFMA. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the AFMA in the course of preparing this environment plan).	AFMA DAFF	There are no requirements arising under this Act that apply to the environmental management of the Activity, however as to aspects of this EP relevant to AFMA's functions, see: Section 3.2.13.1– Commercial Fisheries Section 4 – Consultation Sections 6 and 7 – Planned impacts and unplanned events

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
Marine Orders	Marine Orders are subordinate rules made pursuant to the *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), *Protection of the Sea (Harmful Anti-Fouling Systems) Act 2006* (Cth) and the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (Cth) affecting the maritime industry. They are a means of implementing Australia's international maritime obligations by giving effect to international conventions in Australian law.	Yes – various Marine Orders apply to activities under this EP, including in relation to vessel movements, safety, discharges and emissions. The Marine Orders (MO) relevant to this EP include: • MO 21 – Safety and emergency arrangements • MO 27 – Safety of navigation and radio equipment • MO 30 – Prevention of collisions • MO 41 – Carriage of Dangerous Goods • Marine Order 71 Masters and deck officers • MO 91 – Marine pollution prevention – oil • MO 93 – Marine pollution prevention – noxious liquid substances • MO 94 – Marine pollution prevention – packaged harmful substances • MO 95 – Marine pollution prevention – garbage • MO 96 – Marine pollution prevention – sewage • MO 97 – Marine pollution prevention – air pollution • MO 98 – Marine pollution – anti-fouling systems	AMSA	Discharges to the marine environment will be recorded and controlled in accordance with relevant MOs – refer Section 8.8.2. Santos has implemented control measures directed to ensuring compliance with Marine Orders – refer to Section 8.2.1. Sections 6.5, 6.6, 7.1, 7.2, 7.4, 7.5, 7.6, and 7.7 are relevant to the implementation of MOs.
Marine Safety (Domestic Commercial Vessel) National Law Act 2012 *Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013* (Cth)	This Act is a single regulatory framework for the certification, construction, equipment, design and operation of domestic commercial vessels inside the EEZ. The Act names AMSA as the National Marine Safety Regulator and confers functions on AMSA in relation to marine safety, including that AMSA may make and maintain Marine Orders. The Regulations under the Act set out the definition of a vessel and details and requirements of the accredited marine surveyor scheme.	Yes – all vessel movements associated with the Activity will be governed by AMSA marine safety regulations under the Act. The Act also imposes duties on owners, masters and crew of domestic commercial vessels in relation to the safety of the vessel, relevant to the owners, masters and crew of any Australian Activity vessels under this EP. The Act also sets requirements in relation to the survey of marine vessels which any Australian Activity vessels must comply with.	AMSA	Santos, when engaging vessel contractors, shall assure the vessel contractors compliance with applicable maritime law and regulations (Section 6.1, 6.3, 6.4, 6.5, 7.5, 7.6 and 7.7).
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry 2009	The guidance document provides recommendations for the management of biofouling hazards by the energy industry.	Yes – applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of IMS.	DAFF	Refer to Section 7.2 and especially to Section 7.2.6 which confirms that management is consistent with this Guideline.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
National Greenhouse and Energy Reporting Act 2007 (Cth) (NGER Act) National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015	The NGER Act applies to the atmospheric emissions generated by combustion engine use to operate the vessels associated with the Activity (scope 1 emissions). The NGER Act provides for a single national reporting framework for the reporting and dissemination of information about GHG emissions, GHG projects and energy use and production of corporations. The Safeguard Mechanism is also administered under the NGER Act.	Yes for the broader Barossa Development – the Barossa Development will be a designated large facility under the NGER Act and as such will be subject to the Safeguard Mechanism. This means that Santos, among other things, will have an obligation to ensure that the net covered emissions of GHGs from the operation of the Barossa Development do not exceed the applicable baseline.	DCCEEW Clean Energy Regulator Climate Change Authority	Section 6.5
Native Title Act 1993 (Cth) (NT Act)	The NT Act recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs, and creates processes through which native title can be recognised and protected. Under s 280(2) of the OPGGS Act, petroleum activities must be carried out in a manner that does not interfere with the enjoyment of native title rights and interests under the NT Act to a greater extent than necessary.	No – the NT Act is not directly relevant to environmental management of the Activity. For the Activity, there are no native title claims or determinations that overlap with the OA; however the EMBA does intersect the Croker Island and Larrakia native title determinations. However, the NLC and KLC is a Representative Aboriginal/Torres Strait Islander Body under the NT Act for parts of the OA and EMBA. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the NLC and KLC in the course of preparing this EP).	Commonwealth – Attorney-General's Department Commonwealth – Department of the Prime Minister and Cabinet National Native Title Tribunal Federal Court of Australia	There are no requirements arising under the NT Act that apply to the environmental management of the Activity. Refer to Sections 3.2.13.7 and 3.2.14.3 in relation to relevant heritage values and cultural features more broadly. Refer also to Section 4 in relation to consultation with NLC and KLC.
Navigation Act 2012 (Cth)	The Act aims to promote the SOLAS and safe navigation, prevent pollution of the marine environment and ensure AMSA has the power to carry out inspection of vessels and enforce national and international standards. Specifically, this Act empowers AMSA to make Marine Orders, which are legislative instruments, with respect to any matter for which provision must or may be made by the regulations. A number of Marine Orders enacted under this Act apply directly to offshore petroleum activities: • Marine Order 21: Safety and emergency arrangements • Marine Order 27: Safety of navigation and radio equipment • Marine Order 30: Prevention of collisions	Yes – all vessel movements associated with the Activity will be governed by marine safety regulations and Marine Orders under the Act. See Marine Orders, above.	AMSA	Santos, when engaging vessel contractors, shall assure the vessel contractors compliance with applicable maritime law and regulations (Sections 6.1, 7.6 and 7.7)

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
	• Marine Order 41: Carriage of Dangerous Goods • Marine Order 58: Safe management of vessels • Marine Order 71 Masters and deck officers AMSA has the authority and responsibility for the operational activities under the Act, including vessel certification, seafarers' qualifications, marine pollution prevention, monitoring and enforcement activities.			
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) Offshore Petroleum and Greenhouse Gas Storage Environment Regulations 2023 (Cth)	Petroleum exploration and development activities in Australia's offshore areas are subject to the environmental requirements specified in the OPGGS Act and associated Regulations. The OPGGS Act contains a broad requirement for titleholders to operate in accordance with 'good oil-field practice'. Specific environmental provisions relating to work practices essentially require operators to control and prevent the escape of wastes and petroleum. The Act also requires that activities are carried out in a manner that does not unduly interfere with other rights or interests, including the conservation of the resources of the sea and seabed, such as fishing or shipping. In some cases, where there are particular environmental sensitivities or multiple use issues it may be necessary to apply special conditions to an exploration permit area. The holder of a petroleum title must maintain adequate insurance against expenses or liabilities arising from activities in the title, including expenses relating to clean-up or other remedying of the effects of the escape of petroleum. The OPGGS(E)R provide an objective based regime for the management of environmental performance for Australian offshore petroleum exploration and production activities in areas of Commonwealth jurisdiction. Key objectives of the OPGGS(E)R include to: • ensure operations are performed in a way that is consistent with the principles of ecologically sustainable development • adopt best practice to achieve agreed environment protection standards in industry operations • encourage industry to continuously improve its environmental performance.	Yes – activities under the EP are to be performed: • consistent with the principles of ecologically sustainable development as set out in section 3A of the EPBC Act; and • so environmental impacts and risks of the Activity are reduced to ALARP and are of an acceptable level. This EP must demonstrate that the Activity will be undertaken in line with the principles of ecologically sustainable development, and that impacts and risks resulting from these activities are ALARP and acceptable.	NOPSEMA DISR	Requirements under the OPGGS Act and associated Regulations are addressed throughout this EP.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (Cth) Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (Cth)	Regulates the manufacture, importation and use of ODSs (typically used in fire-fighting equipment and refrigerants). Applicable to the handling of any ODS. The Act provides a licensing system for import, export and manufacture of ODSs and equipment containing ODSs, while the Regulations control the end-use of ODSs, which are licensed by DCCEEW.	Yes – this Act applies where ODS is found on Activity vessel refrigeration systems. The activity vessels may use ODSs and therefore are regulated under this Act.	DCCEEW	Santos, when engaging vessel contractors, shall assure the vessel contractors compliance with applicable maritime law and regulations. Refer also to Section 6.5 and in particular confirmation at Section 6.5.6 that management of emissions is consistent with this Act. Relevant Activity vessels will follow ODS handling procedures.
Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008 (Cth)	This Act implements the requirements for the International Convention on Civil Liability for Bunker Oil Pollution Damage, by imposing insurance certification requirements in respect of regulated Australian vessels carrying more than 2,000 tonnes of oil in bulk as cargo.	No – activities under this EP do not involve the use of any vessels carrying over 2,000 tonnes of oil, as regulated under the Act.	AMSA Department of Infrastructure, Transport, Regional Development, Communications and the Arts	Refer to Section 7.6.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 (Cth)	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the use of harmful organotins in ant-fouling paints used on ships. This is enacted by Marine Order 98 (Marine pollution – anti-fouling systems) 2013.	Yes – this Act applies to vessel movements in Australian Waters associated with the Activity. Vessels are required to have biofouling systems in place to prevent introduction of IMS/harmful impact on Australian biodiversity. Australian ships, or foreign ships in Australian shipping facilities, must not be applied with harmful anti-fouling compounds (organotins). Activity vessels will comply with the relevant requirements of this Act.	AMSA Commonwealth, Department of Infrastructure, Transport, Regional Development, Communications and the Arts	See Section 7.2, and C7.2.1. See also Marine Orders, above.
Protection of the Sea (Powers of Intervention) Act 1981 (Cth) Protection of the Sea (Powers of Intervention) Regulations 1983 (Cth)	This Act authorises the Commonwealth (through AMSA) to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and provides legal immunity for persons acting under an AMSA direction. The Regulations set out requirements to notify AMSA	Yes – this Act applies to vessel discharges and movements associated with the Activity. The Act is relevant in that Santos must comply with Marine Orders made under the Act. See Marine Orders, above. Further, the Act confers powers on AMSA to take action in the event of a spill or likely spill of oil or noxious subjects from a ship, which functions are	AMSA Commonwealth – Department of Infrastructure, Transport, Regional Development,	See also Marine Orders, above.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
	in respect of changes to the ownership or master of a vessel.	relevant in the event of an MDO spill arising from activities under this EP.	Communications and the Arts	
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) *Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994 (Cth)*	This Act and Regulations relate to the protection of the sea from pollution by oil and other harmful substances discharged from ships. This Act disallows any harmful discharge of sewage, oil and noxious substances into the sea and sets the requirements for shipboard management plans, shipboard oil pollution emergency plans, shipboard marine pollution emergency plans, and ship-to-ship operations plans. The following Marine Orders relating to marine pollution prevention have been put in place to give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78: • Marine Order 91: Marine pollution prevention – oil • Marine Order 93: Marine pollution prevention – noxious liquid substances • Marine Order 94: Marine pollution prevention – packaged harmful substances • Marine Order 95: Marine pollution prevention – garbage • Marine Order 96: Marine pollution prevention – sewage • Marine Order 97: Marine pollution prevention – air pollution.	Yes – Santos and its contractors must comply with relevant requirements under this Act and Regulations in respect of Activity vessels, including requirements to have a shipboard oil pollution emergency plan and a marine pollution emergency plan. The requirement to maintain a ship energy efficiency management plan is not applicable to Activity vessels as the vessels will not be engaged on an overseas voyage when undertaking activities under this EP.	AMSA Commonwealth – Department of Infrastructure, Transport, Regional Development, Communications and the Arts	Santos, when engaging vessel owners/contractor, shall assure the vessel contractors compliance with applicable marine orders. Vessel owners/contractors are to ensure the requirements of MARPOL 73/78, this Act and Regulations, and relevant port state Marine Orders are adhered to as relevant to the activities under this EP. See, in particular, Sections 6.6, 7.2, 7.5, 7.6 and 7.7. The requirement for Santos to maintain an oil pollution emergency plan is addressed within the OPEP (see Section 8 for further information). In relation to shipboard marine pollution emergency plans, see Section 8.5 – Emergency preparedness and response of this EP, as well as C7.5.5.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
Underwater Cultural Heritage Act 2018 (Cth) (UCH Act)	The UCH Act replaced the *Historic Shipwrecks Act 1976* (Cth) and extends protection to other wrecks such as submerged aircraft and to human remains. The UCH Act protects the heritage values of vessels and aircrafts and the remains of vessels and aircrafts that have been in Australian waters. Heritage that has been in Australian waters for at least 75 years is automatically protected, while other heritage can be declared to be protected by the Minister. It is an offence to interfere with heritage covered by this Act. Key obligations include: • not disturbing protected underwater heritage during the course of a proposed action without a permit • observing the requirements of protected zones and obtaining a permit to enter one if required • notifying of the discovery of any suspected underwater heritage identified during the course of proposed action within 21 days of discovery.	Yes – Santos has identified that no known listed historic shipwrecks or plane wrecks occur within the OA, and multiple known historic aircraft and shipwrecks and other sites occur within the EMBA. Despite this, there is no predicted impact to cultural heritage values in relation to shipwrecks or plane wrecks resulting from activities under the EP, including from unplanned risks. Although there are no presently predicted impacts, the UCH Act imposes obligations in the event of an article of heritage being discovered. The UCH Act requires that that anyone who finds an article of underwater cultural heritage which appears to be of an archaeological character needs to notify the relevant authorities, via online form.	Commonwealth – DCCEEW	Reporting obligations under the UCH Act are addressed in Table 8-5. As to Santos' assessment of existing heritage under the UCH Act, see Section 3.2.13.7.
NT Legislation				
Environment Protection Act 2019 (NT)	This Act regulates the general environmental assessment process in the NT. The objects of the Act are to: • promote ecologically sustainable development • recognise the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment in the NT • provide for broad community involvement and to recognise the role that Aboriginal people have as stewards of their country.	Yes – in December 2023, the DPD Project (in NT waters) was approved under the Act following assessment by the NT EPA, subject to certain conditions relating to environmental management for activities in NT jurisdiction. The Act may also apply to the extent that a credible spill scenario may result in impact to NT waters.	EPA (NT)	There are no requirements arising under this Act that apply to planned activities under this EP. In the event of a spill scenario that impacts the NT, Santos will implement its spill response operations. Sections 7.6 – Hydrocarbon release Section 7.7 – Spill Response Operations.
Fisheries Act 1988 (NT) Fisheries Regulations 1992 (NT)	This Act provides for the regulation, conservation and management of fisheries and fishery resources so as to maintain their sustainable utilisation, to regulate the sale and processing of fish and aquatic life, and for related purposes.	No – this Act is not directly relevant to the environmental management of the Activity. However, for a Joint Authority Fishery (such as the Timor Reef Fishery), in the event of an emergency, this Act provides the regulatory framework for the	NT Department of Industry, Tourism and Trade – Fisheries Division	There are no requirements arising under the Act that apply to the environmental

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
		Joint Authority to make any necessary fisheries management decisions. The OA overlaps the Timor Reef Fishery which is jointly managed by the NT and Commonwealth. The EMBA intersects with numerous NT-managed fisheries regulated under this Act. Accordingly, this Act has been identified for completeness (and to provide context for the consultation undertaken by Santos with the NT Department of Industry, Tourism and Trade in the course of preparing this EP).		management of the Activity, however as to aspects of this EP relevant to the NT Department of Industry, Tourism and Trade's functions, see: Section 3.2.13.1 – Commercial Fisheries Sections 4, 6 and 7.
Heritage Act 2011 (NT)	This Act establishes the NT Heritage Council and governs protection of both natural and cultural heritage places and objects within the NT jurisdiction by establishing heritage offences and regulating activities that may impact heritage places and objects, including through a process for obtaining work approvals.	Yes – this Act is applicable to the extent that unplanned events may impact natural and cultural heritage places or objects in the NT, constituting a heritage offence under the Act.	DTFHC-NT-Heritage	There are no requirements arising under this Act that apply to planned activities under this EP, however for aspects of this EP addressing unplanned events, which are relevant to avoiding impacts to natural and cultural heritage places or objects, see: Section 7 – Unplanned events risk and impact assessment.
Territory Parks and Wildlife Conservation Act 1976 (NT)	This Act provides for the establishment of Territory Parks and other Parks and Reserves and the study, protection, conservation and sustainable utilization of wildlife in the NT. The Act relevantly provides for the classification of the conservation status of wildlife in the NT.	Yes – this Act is applicable to the extent that a credible spill scenario may result in impact to NT listed threatened fauna species and protected species.	EPA (NT)	There are no requirements arising under this Act that apply to planned activities under this EP. In the event of a spill scenario that impacts the NT, Santos will implement its spill response operations. Sections 7.6 – Hydrocarbon release

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
				Section 7.7 – Spill Response Operations.
International agreements and conventions				
1997 Treaty between Australia and Indonesia establishing an EEZ Boundary and Certain Seabed Boundaries (Perth Treaty)	This treaty has been signed but not yet ratified. When ratified, the treaty will finalise the EEZ boundary between Australia and Indonesia. Under the Perth Treaty, there are areas of overlapping jurisdiction where Australia exercises seabed jurisdiction including exploration for petroleum, and Indonesia exercises water column jurisdiction including fishing rights.	Yes – the southern boundary of the Perth Treaty is near the OA and within the EMBA. Although the Treaty has not been ratified and imposes no obligations on Santos, it is relevant to Santos' assessment of potential Relevant Persons and has therefore been identified in for completeness.	N/A	There are no requirements arising under the Treaty that apply to the environmental management of the Activity.
Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and Their Environment 1974 (JAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Japan. Implemented in the EPBC Act. Birds listed on the annex to this agreement must be placed on the migratory species list under the EPBC Act.	Yes – only to the extent that a credible spill scenario may result in impact to migratory seabirds foraging in the EMBA.	N/A	In the event of a spill scenario that impacts migratory birds, Santos will implement its spill response operations. Section 3.2.12 – Threatened and migratory fauna Sections 7.6 – Hydrocarbon release Section 7.7 – Spill Response Operations
Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and Their Environment 1986 (CAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and China. Implemented in the EPBC Act.	Yes – only to the extent that a credible spill scenario may result in impact to migratory seabirds foraging in the EMBA.	N/A	In the event of a spill scenario that impacts migratory birds, Santos will implement its spill response operations. Section 3.2.12 – Threatened and migratory fauna Sections 7.6 – Hydrocarbon release Section 7.7 – Spill Response Operations
Agreement Between the Government of Australia and the Government of	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia	Yes – only to the extent that a credible spill scenario may result in impact to migratory seabirds foraging in the EMBA.	N/A	In the event of a spill scenario that impacts migratory birds,

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
the Republic of Korea for the Protection of Migratory Birds 2006 (ROKAMBA)	and Korea. Implemented in EPBC Act. Birds listed on the annex to this agreement must be placed on the migratory species list under the EPBC Act.			Santos will implement its spill response operations. Section 3.2.12 – Threatened and migratory fauna Sections 7.6 – Hydrocarbon release Section 7.7 – Spill Response Operations
Convention on Biological Diversity 1992	This convention has 3 main objectives: the conservation of biodiversity; the sustainable use of its components; and the fair and equitable sharing of the benefits arising from the use of genetic resources.	Yes – relevant only insofar as the Activity may interact with MNES (threatened and migratory species) protected under the EPBC Act.	N/A	Section 3.2 – Existing Environment Section 6 – Planned activities risk and impact assessment Section 7 – Unplanned events risk and impact assessment
Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)	The Bonn Convention aims to improve the status of all threatened migratory species through national action and international agreements between range states of particular groups of species.	Yes – only relevant in so far as the credible spill scenario may result in impact to MNES protected migratory species.	N/A	Section 3.2 – Existing Environment Section 7 – Unplanned events risk and impact assessment
Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)	Convention prescribes internationally agreed measures for the navigation, management and working of a vessel, and the lights and signals to be provided and used on a vessel. Given effect in Australia by Marine Order 30 – Prevention of Collisions.	Yes – refer to *Navigation Act 2012* (Cth) and Marine Orders	N/A	Santos has implemented control measures directed to ensuring compliance with Marine Orders – refer to Section 8.2.1.
International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004	This Convention was adopted by the IMO and entered into force globally in 2017. It aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for managing and controlling ships' ballast water and sediments. Thus, ballast water management systems must be approved in accordance with this Convention. From 8 September 2017, all vessels that use ballast water are required to meet the Regulation D2	Yes – refer to Australian Ballast Water Management Requirements	N/A	Refer to Section 6.6 and 7.2.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
	discharge standard of this Convention at their next renewal survey.			
International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)	This Convention and Protocol (together known as MARPOL 73/78) build on earlier conventions in the same area. MARPOL is concerned with operational discharges of pollutants from ships. It contains 6 Annexes, dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage, garbage and air pollution. Detailed rules are laid out as to the extent to which (if at all) such substances can be released in different sea areas. The legislation giving effect to MARPOL in Australia is the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and several Parts of Marine Orders made under this legislation.	Yes – refer to *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), *Navigation Act 2012* (Cth) and Marine Orders	N/A	Sections 6 and 7 – Planned and unplanned events
International Convention for the Safety of Life at Sea 1974 (SOLAS) and its Protocol of 1988	This convention is generally regarded as the most important of all international treaties concerning the safety of merchant ships. Implemented by the *Navigation Act 2012* (Cth) and Marine Orders under that Act.	Yes – refer to *Navigation Act 2012* (Cth) and Marine Orders	N/A	Section 6.1– Interactions with other marine users Section 8 – Implementation strategy
International Convention on Oil Pollution Preparedness, Response and Co operation 1990 (OPRC 90)	This convention comprises national arrangements for responding to oil pollution incidents from ships, offshore oil facilities, sea ports and oil handling. The convention recognises that in the event of pollution incident, prompt and effective action is essential. Parts of this convention are implemented by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth).	Yes – in the event of a worst-case credible spill scenario, this may enact a national arrangement for response. Refer to *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth).	N/A	In the event of a spill scenario, Santos will implement its spill response operations. Sections 7.6 – Hydrocarbon release Section 7.7 – Spill Response Operations
International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers, 1978	Prescribes internationally agreed minimum standards relating to training, certification and watchkeeping for seafarers. Given effect in Australia by Marine Order 71 (Masters and Deck Officers).	Yes – refer to *Navigation Act 2012* (Cth) and Marine Orders	N/A	Santos has implemented control measures directed to ensuring compliance with Marine Orders – refer to Section 8.2.1.
Memorandum of Understanding between Australia and Indonesia on the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing	Enables traditional fishing by Indonesian traditional fishers within the sections of the Australian EEZ.	There are no requirements arising under the Treaty that apply to the environmental management of the Activity.	N/A	See Section 4 – Consultation.

Legislation	Summary	Applicable to Activity and relevant to environmental management?	Administering authority	How Santos will meet requirements
Zone and Continental Shelf – 1974				
Paris Agreement on Climate Change 2015	This Agreement aims to tackle climate change and its negative impacts. It sets the long-term goal of substantially reducing global GHG emissions to limit global temperature rise this century well below 2°C above pre-industrial levels while pursuing efforts to limit the temperature increase even further to 1.5 °C to prevent dangerous human-caused interference with the climate system.	Yes - provides the international framework and context around Australia's nationally determined contributions. This helps establish the defined acceptable level of Barossa Gas Project GHG emissions. See also Climate Change Act.	N/A	Refer to Section 6.5 which refers to Santos' Climate Change Policy.
United Nations Educational, Scientific and Cultural Organization Convention on the Protection of Underwater Cultural Heritage 2001	This Convention provides a framework preservation and protection of underwater cultural heritage. This includes traces of human existence of cultural, historical, or archaeological nature that have been submerged for at least 100 years. This Convention is aligned with the sustainable development objectives of the United Nations Agenda 2030.	Yes - provides the framework to protect and reduce the impact of Barossa installation activities on underwater heritage.	N/A	N/A
United Nations Framework Convention on Climate Change 1992	The objective of the convention is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. Australia ratified the convention in December 1992 and it came into force on 21 March 1994.	Yes – only relevant to the extent that to reduce impact of GHG emissions associated with activity vessel use, Santos will comply with MARPOL Annex VI (Marine Order 97: Marine pollution prevention – air pollution) and require the use of low sulphur fuel.	N/A	Santos will comply with Marine Order 97. Section 6.5 – Atmospheric emissions

Appendix C Consideration of the indirect consequences under section 527E of the EPBC Act

Subsection 75(2) of the EPBC Act requires that the Minister responsible for administering the EPBC Act, or their delegate when deciding whether an action is a controlled action, consider 'all adverse impacts (if any)' the action has, will have, or is likely to have, on protected matters.

For the purposes of the Act, under section 527E(1) an event or circumstance is an 'impact' of an action taken by a person if: (a) the event or circumstance is a direct consequence of the action; or (b) for an event or circumstance that is an indirect consequence of the action—subject to subsection 527E(2), the action is a substantial cause of that event or circumstance.

In respect to section 527E(1)(b), events/circumstances that are a result of actions taken by a third party (called a 'secondary action'), such as those arising in the context of scope 3 GHG emissions, will only be an indirect consequence of the action (called the 'primary action') where:

- the action is a substantial cause of the event or circumstance
- the primary action facilitates the secondary action to a major extent
- both the secondary action and event/circumstance is either within the contemplation of the proponent of the primary action or is a reasonably foreseeable consequence of the primary action.

Santos has considered the potential for 'indirect consequences' to arise in relation to the Barossa Gas Project and specifically the petroleum activity that is the subject of this EP. In this context, for the purposes of applying section 527E(1)(b) and (2) of the EPBC Act to the OPGGS(E)R regulatory regime:

- the 'event or circumstances' is consumption or combustion of gas by a third party
- the 'impact' is emission of GHGs
- the 'action' is:
  - the whole Barossa Development in the context of an OPP assessment
  - the particular petroleum activity (or activities) in the context of an EP assessment.

The OPP for the Barossa Development was submitted by Santos in October 2016 and accepted by NOPSEMA in March 2018. A comprehensive environmental impact assessment was completed in accordance with established practice and policies at that time.

In the context of an EP, the nature of the 'petroleum activity' will determine the scope of relevant 'indirect consequences'. This may be a subset of the consequences that are relevant when undertaking an OPP assessment, as the activities are a component of the project as a whole.

For an event or circumstance to be an indirect consequence of a petroleum activity, the petroleum activity must be demonstrated as:

- a substantial cause of that event or circumstance (s. 527E(1)(b)); and
- facilitating, to a major extent, the action taken by the third party (as further explained in s. 527E(2)).

Neither the term 'substantial' or 'major' is defined in the EPBC Act. In accordance with typically usage and dictionary definitions:

- 'substantial' means weighty or big, in a relative sense to be considerable and with reference to degrees of relevance, something more than significant
- 'major' means greater in size, amount, importance etc. and constituting the majority or larger part.

In the context of this EP, the scope of relevant petroleum activity is limited to the Activity. The EP does not permit commissioning and operating the Barossa facilities required to produce and transport the reservoir hydrocarbons (i.e. natural gas). Notably in relation to s.527E(1)(b) and (2):

- No natural gas is recovered as a result of the Activity. Several subsequent, interposed petroleum activities must be authorised under the OPGGS(E)R and then undertaken before any gas is capable of being recovered.

- Gas consumption/combustion cannot reasonably be said to have been facilitated by a petroleum activity, which has no resource extraction component. Even if some kind of facilitation could be observed, the Activity cannot reasonably be characterised as an important or majority facilitator of that action. These activities are multiple steps removed from such a characterisation. Therefore, the Activity is not a primary action to a secondary action involving gas consumption/combustion.
- There is a chain of events before resource (i.e. natural gas) recovery, and then a chain of events afterwards and ahead of any resource being consumed by a third party. From a causal perspective, the link between the Activity and a third-party GHG emission is weak. This petroleum activity cannot reasonably be characterised as having a weighty/big, considerable or significant causal relationship to third-party gas consumption/combustion.

In this context, Santos has concluded that the Activity does not facilitate to a major extent natural gas consumption/combustion and this petroleum activity is not a substantial cause of any associated scope 3 GHG emissions.

Santos will submit Barossa Gas Project EPs to extract, produce and transport the natural gas. Santos will have no ability to extract the natural gas until these petroleum activities have been assessed, meet the criteria in section 34 of the OPGGS(E)R and the EPs have been accepted by NOPSEMA.

The causal relationship between production operations petroleum activities and consumption or combustion of gas by a third party is different in those circumstances. Santos will consider such indirect consequences in its future Barossa Production Operations EP.

Appendix D EPBC Act protected matters reports

Appendix D1 – OA EPBC Act protected matters report

Appendix D2 – EMBA EPBC Act protected matters report

Appendix D3 – MEVA EPBC Act protected matters report

Appendix D4 – OA with 20km Assessment Boundary EPBC Act protected matters report

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. Please see the caveat for interpretation of information provided here.

Report created: 12-Jun-2024

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	38

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	61
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	2

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	5
Key Ecological Features (Marine):	1
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat may occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
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
REPTILE		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat 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	Congregation or aggregation known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
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

Scientific Name	Threatened Category	Presence Text
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 may 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
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may 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	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
[Crocodylus porosus](#) Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely 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	Congregation or aggregation known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 may 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 sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may 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 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

Scientific Name	Threatened Category	Presence Text
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
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 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

Scientific Name	Threatened Category	Presence Text
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
Reptile		
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
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	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		

Current Scientific Name	Status	Type of Presence
[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]		Species or species habitat likely to occur within area
[Orcaella heinsohni](#) Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Pseudorca crassidens](#) False Killer Whale [48]		Species or species habitat likely to occur within area
[Sousa sahulensis](#) Australian Humpback Dolphin [87942]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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 may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str.		
Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea		
Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Controlled action			
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Not controlled action			
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Not controlled action (particular manner)			

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van Diemen Rise	North

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		
Natator depressus		
Flatback Turtle [59257]	Internesting	Likely to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Protected Matters - Print Map - June 12th 2024
Timor Sea
Arafura Sea
25
Darwin
Timor Sea
Tipperary
20 km
10 mi

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. Please see the caveat for interpretation of information provided here.

Report created: 12-Jun-2024

Summary

Matters of National Environment 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:	1
National Heritage Places:	1
Wetlands of International Importance (Ramsar	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	69
Listed Migratory Species:	76

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	45
Commonwealth Heritage Places:	7
Listed Marine Species:	119
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	6
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	6
Regional Forest Agreements:	None
Nationally Important Wetlands:	6
EPBC Act Referrals:	80
Key Ecological Features (Marine):	4
Biologically Important Areas:	17
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
Kakadu National Park	NT	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Natural		
Kakadu National Park	NT	Listed place

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Cobourg peninsula	Within Ramsar site
Kakadu national park	Within Ramsar site

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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting 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	Roosting known to occur within area
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	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 known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	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 within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Phaethon rubricauda westralis Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat likely to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Tyto novaehollandiae melvillensis Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat may occur within area
FROG		

Scientific Name	Threatened Category	Presence Text
Uperoleia daviesae		
Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat known to occur within area
MAMMAL		
Antechinus bellus		
Fawn Antechinus [344]	Vulnerable	Species or species habitat known 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 likely to 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 known to 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
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
Mesembriomys gouldii melvillensis		
Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	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

Scientific Name	Threatened Category	Presence Text
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat known 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
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat known 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 within area
PLANT		
Burmannia championii listed as Burmannia sp. Bathurst Island (R.Fensham 1021) [93461]	Endangered (listed as Burmannia sp. Bathurst Island	Species or species habitat likely to occur within area
Elaeocarpus miegei [65147]	Endangered	Species or species habitat may occur within area
Hoya australis subsp. oramicola a vine [55436]	Vulnerable	Species or species habitat known to occur within area
Stylidium ensatum a triggerplant [86366]	Endangered	Species or species habitat known to occur within area
Tarennoidea wallichii [65173]	Endangered	Species or species habitat likely to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat likely to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat likely to occur within area
REPTILE		
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	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Lucasium occultum Yellow-snouted Gecko, Yellow-snouted Ground Gecko [82993]	Endangered	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Tiliqua scincoides intermedia Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Varanus mertensi		
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli		
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat known to occur within area
SHARK		
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	Breeding known to occur within area
Glyphis glyphis		
Speartooth Shark [82453]	Critically Endangered	Species or species habitat known to 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
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		

Scientific Name	Threatened Category	Presence Text
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
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
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding known to 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour 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

Scientific Name	Threatened Category	Presence Text
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		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]		Breeding 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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
[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 known to occur within area
Migratory Wetlands Species		
[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]	Vulnerable	Roosting known to occur within area
[Calidris acuminata](#)		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	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]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting 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	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area

Scientific Name	Threatened Category	Presence Text
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known 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]	Endangered	Roosting 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]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State
Attorney-General - Australian Government Solicitor	
Commonwealth Land - Australian Government Solicitor [70089]	NT
Commonwealth Land - Australian Government Solicitor [70450]	NT
Commonwealth Land - Australian Government Solicitor [70332]	NT
Commonwealth Land - Australian Government Solicitor [70996]	NT
Commonwealth Land - Australian Government Solicitor [70092]	NT
Commonwealth Land - Australian Government Solicitor [71135]	NT
Commonwealth Land - Deputy Crown Solicitor [70334]	NT
Commonwealth Land - Deputy Crown Solicitor [70994]	NT
Commonwealth Land - Deputy Crown Solicitor [70333]	NT
Defence	
Defence - AUSTRALIAN ARMY BAND - DARWIN [70042]	NT
Defence - DARWIN - AP10 RADAR SITE - LEE POINT [70021]	NT

Commonwealth Land Name	State
Defence - DARWIN - AP3 RECEIVING STATION - LEE POINT [70044]	NT
Defence - DARWIN RELOCATIONS CENTRE [70045]	NT
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE [70046]	NT
Defence - Esanda Builidng [70048]	NT
Defence - LARRAKEYAH BARRACKS [70061]	NT
Defence - LEANYER BOMBING RANGE [70022]	NT
Defence - LEANYER BOMBING RANGE [70023]	NT
Defence - MT GOODWIN RADAR SITE [70063]	NT
Defence - Patrol Boat Base (DARWIN NAVAL BASE) [70041]	NT
Defence - QUAIL ISLAND BOMBING RANGE [70003]	NT
Defence - RAAF BASE DARWIN [70073]	NT
Defence - SHOAL BAY RECEIVING STATION [70037]	NT
Defence - STOKES HILL OIL FUEL INSTALLATION [70035]	NT
Defence - WINNELLIE TWO [70077]	NT
Defence - Defence Housing Authority	
Commonwealth Land - Director of Property Services Defence Estate [70856]	NT
Commonwealth Land - Director of Property Services Defence Estate [70855]	NT
Environment and Heritage	
Commonwealth Land - Kakadu National Park [70850]	NT
Finance and Administration	
Commonwealth Land - Department of Administrative Services [70091]	NT
Commonwealth Land - Department of Administrative Services [70590]	NT
Immigration and Multicultural and Indigenous Affairs - Department of Immigration Local Government and Ethnic Affairs	
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs [70336]	NT
Transport and Regional Services	
Commonwealth Land - Department of Transport & Regional Development [70207]	NT
Unknown	

Commonwealth Land Name	State
Commonwealth Land - [70335]	NT
Commonwealth Land - [70337]	NT
Commonwealth Land - [70995]	NT
Commonwealth Land - [70993]	NT
Commonwealth Land - [70090]	NT
Commonwealth Land - [70593]	NT
Commonwealth Land - [70203]	NT
Commonwealth Land - [70591]	NT
Commonwealth Land - [70327]	NT
Commonwealth Land - [70204]	NT
Commonwealth Land - [70205]	NT
Commonwealth Land - [70206]	NT
Commonwealth Land - [70447]	NT

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
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	Listed place

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
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 overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area overfly marine area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area overfly marine 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	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
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]		Roosting known to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine 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]		Roosting known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area overfly marine area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area overfly marine area
Tringa incana as Heteroscelus incanus Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area
Fish		

Scientific Name	Threatened Category	Presence Text
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
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 intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
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

Scientific Name	Threatened Category	Presence Text
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

Scientific Name	Threatened Category	Presence Text
[Trachyrhamphus longirostris](#) Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
[Dugong dugon](#) Dugong [28]		Species or species habitat known to occur within area
Reptile		
[Aipysurus duboisii](#) Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
[Aipysurus laevis](#) Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
[Aipysurus mosaicus as Aipysurus eydouxii](#) Mosaic Sea Snake [87261]		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	Foraging, feeding or related behaviour known to occur within area
[Emydocephalus annulatus](#) Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		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 Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
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 likely to occur within area

Current Scientific Name	Status	Type of Presence
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]		Species or species habitat likely to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		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

Commonwealth Reserves Terrestrial [Resource Information]

Name	State	Type
Kakadu	NT	National Park (Commonwealth)

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	National Park Zone (IUCN II)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur
Dermochelys coriacea		
Leatherback Turtle [1768]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea		
Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Casuarina	Coastal Reserve	NT
Charles Darwin	National Park	NT
Djukbinj	National Park	NT

Protected Area Name	Reserve Type	State
Garig Gunak Barlu	National Park	NT
Garig Gunak Barlu	Marine Park	NT
Mary River	National Park	NT

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Adelaide River Floodplain System	NT
Cobourg Peninsula System	NT
Finniss Floodplain and Fog Bay Systems	NT
Kakadu National Park	NT
Mary Floodplain System	NT
Port Darwin	NT

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Bayview, The Boulevarde, Darwin, NT	2015/7466		Assessment
Berrimah Freight Terminal Expansion Project	2024/09847		Referral Decision
Clarence Strait Offshore Tidal Energy Project	2008/4660		Assessment
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Darwin Pipeline Duplication DPD Project	2022/9166		Completed
Darwin Ship Lift Project	2021/9068		Post-Approval
East Arm Marine Industry Park, Darwin, NT	2014/7318		Completed
Establishment and operation of a refinery at Darwin, NT	2015/7604		Assessment
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Referral Decision
Proposed City of Weddell	2011/6090		Assessment

Controlled action

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Augmentation of the East Point Effluent Rising Main and Extension of East Point Outfall	2009/5113	Controlled Action	Post-Approval
Barramundi Nursery Farm	2005/2378	Controlled Action	Completed
Bonaparte Liquified Natural Gas Project	2011/6141	Controlled Action	Post-Approval
Condensate Processing Facility, East Arm	2006/2734	Controlled Action	Proposed Decision
Darwin to Moomba Gas Pipeline	2001/213	Controlled Action	Completed
Development of Blacktip Gas Field	2003/1180	Controlled Action	Post-Approval
East Arm Wharf Expansion Works	2010/5304	Controlled Action	Post-Approval
Glyde Point and Middle Arm Peninsula Infrastructure Support	2001/334	Controlled Action	Completed
Glyde Point Industrial Estate	2001/336	Controlled Action	Completed
Glyde Point Industrial Estate and Associated Infrastructure	2004/1506	Controlled Action	Completed
Hardwood Plantation	2001/229	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT	2012/6587	Controlled Action	Assessment Approach
Lee Point Master-planned urban development, Darwin, NT	2015/7591	Controlled Action	Post-Approval
Methanol Plant	2001/195	Controlled Action	Completed
Middle Arm Peninsula Industrial Area Development	2001/339	Controlled Action	Completed
Mt Peake iron, vanadium and titanium mining project & assoc infrastructure, 280kms NNW Alice Springs	2013/7027	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Muirhead Subdivision	2010/5525	Controlled Action	Post-Approval
Operation of 17 Tiger Helicopters at Robertson Barracks	2004/1459	Controlled Action	Post-Approval
Port Patterson Barramundi Sea Cage Farm	2005/2149	Controlled Action	Completed
Replacement of the East Point Outfall	2011/6099	Controlled Action	Assessment Approach
Residential subdivision of Lot 9793 (formerly Lots 9774 and 9779) Lee Point Road	2005/2108	Controlled Action	Post-Approval
Shipping Channel Enhancement	2010/5431	Controlled Action	Completed
Talisman Saber 2005 Military Exercise	2004/1819	Controlled Action	Post-Approval
Trans-territory Gas Pipeline	2003/1186	Controlled Action	Completed
Tropical Tidal Testing Centre, Clarence Strait, 50km NE Darwin	2014/7299	Controlled Action	Guidelines Issued
Not controlled action			
2D seismic survey, exploration permit NT/P67	2004/1587	Not Controlled Action	Completed
2D Seismic Survey in Permit Areas WA-318-P & WA-319-P, near Cape Londonderry	2004/1687	Not Controlled Action	Completed
Channel Island Bridge Pipeline Replacement Project	2020/8672	Not Controlled Action	Completed
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Cox Peninsular Remediation Project, NT	2015/7587	Not Controlled Action	Completed
Crowley Government Services Inc Bulk Fuel Storage Facility	2021/9015	Not Controlled Action	Completed
Darwin Port Maintenance Dredging, Darwin Harbour, NT	2017/8122	Not Controlled Action	Completed
Darwin ship lift facility and marine industries project, Darwin Harbour NT	2018/8195	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Nexus Drilling Program NT-P66	2007/3745	Not Controlled Action	Completed
Project Sea Dragon Stage 1 Hatchery - Gunn Point, NT	2017/8092	Not Controlled Action	Completed
Residential Complex - Lots 6575 and 6576	2001/163	Not Controlled Action	Completed
Waterfront Redevelopment	2003/1256	Not Controlled Action	Completed
Wickham Point Interconnect Gas Pipeline	2008/4309	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2008/4133	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2009/5104	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey within permit area WA-318-P	2007/3879	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2009/4681	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Dredging the outer shipping channels of Darwin Harbour	2013/6988	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling in Permit Areas WA-402-P & WA-403-P	2010/5297	Not Controlled Action (Particular Manner)	Post-Approval
Fishburn2D Marine Seismic Survey	2012/6659	Not Controlled Action (Particular Manner)	Post-Approval
Floyd 3D and Chisel 3D Seismic Surveys	2011/6220	Not Controlled Action (Particular Manner)	Post-Approval
Gold 2D Marine Seismic Survey Permit Areas WA375P and WA376P	2009/4698	Not Controlled Action (Particular Manner)	Post-Approval
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Malita West 3D Seismic Survey WA-402-P and WA-403-P	2007/3936	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval
NT/P80 2010 2D Marine Seismic Survey	2010/5487	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Petrel MC2D Marine Seismic Survey	2010/5368	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Santos Petrel-7 Offshore Appraisal Drilling Programme (Bonaparte Basin)	2011/5934	Not Controlled Action (Particular Manner)	Post-Approval
Sonar and Acoustic Trials	2001/345	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
Phillips Petroleum Wickham Point LNG facility	2001/391	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Sahul Shelf	North-west

Name	Region
Carbonate bank and terrace system of the Van Diemen Rise	North
Pinnacles of the Bonaparte Basin	North-west
Pinnacles of the Bonaparte Basin	North

Biologically Important Areas		[Resource Information]
Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur
Dermochelys coriacea Leatherback Turtle [1768]	Internesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Likely to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Onychoprion anaethetus Bridled Tern [82845]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding (high numbers)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Protected Matters - Print Map - June 12th 2024
Nusa Tenggara Timur
Kupang
TIMOR-LESTE
Timor Sea
Darwin
Kalumburu
Kununurra
50 km
30 mi

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. Please see the caveat for interpretation of information provided here.

Report created: 12-Jun-2024

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	63
Listed Migratory Species:	75

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	117
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	2

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	30
Key Ecological Features (Marine):	1
Biologically Important Areas:	5
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	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]	Vulnerable	Roosting 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	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	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 within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Tringa nebularia](#)		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
[Tyto novaehollandiae kimberli](#)		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
[Tyto novaehollandiae melvillensis](#)		
Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
[Xenus cinereus](#)		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area
FISH		
[Thunnus maccoyii](#)		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat may occur within area
FROG		
[Uperoleia daviesae](#)		
Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat may occur within area
MAMMAL		
[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 likely to 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
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
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
Mesembriomys gouldii melvillensis Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat likely to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat may 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
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat known 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 within area
PLANT		
Burmannia championii listed as Burmannia sp. Bathurst Island (R.Fensham 1021) [93461]	Endangered (listed as Burmannia sp. Bathurst Island	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
[Tarennoidea wallichii](#) [65173]	Endangered	Species or species habitat likely to occur within area
[Typhonium jonesii](#) a herb [62412]	Endangered	Species or species habitat likely to occur within area
[Typhonium mirabile](#) a herb [79227]	Endangered	Species or species habitat likely to occur within area
[Xylopia monosperma](#) a shrub [82030]	Endangered	Species or species habitat likely to occur within area
REPTILE		
[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	Foraging, feeding or related behaviour 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

Scientific Name	Threatened Category	Presence Text
Tiliqua scincoides intermedia		
Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat likely to occur within area
Varanus mertensi		
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli		
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat likely to occur within area
SHARK		
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	Breeding known to occur within area
Glyphis glyphis		
Speartooth Shark [82453]	Critically Endangered	Species or species habitat known to 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 likely 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
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text

Scientific Name	Threatened Category	Presence Text
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
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
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding known to 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 likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Foraging, feeding or related behaviour 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

Scientific Name	Threatened Category	Presence Text
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		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 likely 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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
[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 known to occur within area
Migratory Wetlands Species		
[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]	Vulnerable	Roosting known to occur within area
[Calidris acuminata](#)		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	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]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting 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	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting known to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area

Scientific Name	Threatened Category	Presence Text
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known 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]	Endangered	Roosting 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]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa incana		
Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State
Defence	
Defence - DARWIN - AP10 RADAR SITE - LEE POINT [70021]	NT
Defence - DARWIN - AP3 RECEIVING STATION - LEE POINT [70044]	NT
Defence - LEANYER BOMBING RANGE [70023]	NT
Defence - LEANYER BOMBING RANGE [70022]	NT
Defence - QUAIL ISLAND BOMBING RANGE [70003]	NT

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat may occur within area overfly marine area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area overfly marine 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	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
[Gallinago megala](#) Swinhoe's Snipe [864]		Roosting known to occur within area overfly marine area
[Gallinago stenura](#) Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
[Glareola maldivarum](#) Oriental Pratincole [840]		Roosting known to occur within area overfly marine area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Himantopus himantopus](#) Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
[Limnodromus semipalmatus](#) Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine 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]		Roosting known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Breeding known to occur within area
Stiltia isabella		
Australian Pratincole [818]		Roosting known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes		
Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area overfly marine area
Tringa incana as Heteroscelus incanus		
Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area
Fish		
Bhanotia fasciolata		
Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus		
Three-keel Pipefish [66192]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		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

Scientific Name	Threatened Category	Presence Text
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
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

Scientific Name	Threatened Category	Presence Text
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
Mammal		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptile		

Scientific Name	Threatened Category	Presence Text
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		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
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		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 Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
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 likely to 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

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely 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
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		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

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Oceanic Shoals	Habitat Protection Zone (IUCN IV)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		

Scientific Name	Behaviour	Presence
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea		
Olive Ridley Turtle [1767]	Nesting	Known to occur

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Casuarina	Coastal Reserve	NT
Djukbinj	National Park	NT

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Clarence Strait Offshore Tidal Energy Project	2008/4660		Assessment
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Darwin Pipeline Duplication DPD Project	2022/9166		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Referral Decision
Controlled action			
Darwin to Moomba Gas Pipeline	2001/213	Controlled Action	Completed
Glyde Point Industrial Estate	2001/336	Controlled Action	Completed
Glyde Point Industrial Estate and Associated Infrastructure	2004/1506	Controlled Action	Completed
Hardwood Plantation	2001/229	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Lee Point Master-planned urban development, Darwin, NT	2015/7591	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Operation of 17 Tiger Helicopters at Robertson Barracks	2004/1459	Controlled Action	Post-Approval
Residential subdivision of Lot 9793 (formerly Lots 9774 and 9779) Lee Point Road	2005/2108	Controlled Action	Post-Approval
Shipping Channel Enhancement	2010/5431	Controlled Action	Completed
Tropical Tidal Testing Centre, Clarence Strait, 50km NE Darwin	2014/7299	Controlled Action	Guidelines Issued
Not controlled action			
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Project Sea Dragon Stage 1 Hatchery - Gunn Point, NT	2017/8092	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Dredging the outer shipping channels of Darwin Harbour	2013/6988	Not Controlled Action (Particular Manner)	Post-Approval
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van Diemen Rise	North

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Marine Turtles		
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Internesting	Likely to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Protected Matters - Print Map - June 12th 2024
Timor Sea
Arafura Sea
Arafura Sea
118
Darwin
Tipperary
20 km
10 mi

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. Please see the caveat for interpretation of information provided here.

Report created: 12-Jun-2024

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	40

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	67
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	2

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	11
Key Ecological Features (Marine):	1
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
Commonwealth Marine Areas (EPBC Act)	In feature area
Commonwealth Marine Areas (EPBC Act)	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
FISH			
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat may occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In feature area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area	In feature area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Lepidochelys olivacea](#) Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area	In feature area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area	In feature area
SHARK			
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area	In feature area
[Glyphis garricki](#) Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In buffer area only
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In feature area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In feature area
Migratory Marine Species			
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area	In feature area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In feature area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In feature area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In feature area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area	In feature area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Crocodylus porosus](#) Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
[Dugong dugon](#) Dugong [28]		Species or species habitat known to occur within area	In buffer area only
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Isurus oxyrinchus](#) Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area	In feature area
[Isurus paucus](#) Longfin Mako [82947]		Species or species habitat likely to occur within area	In feature area
[Lepidochelys olivacea](#) Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area	In feature area
[Megaptera novaeangliae](#) Humpback Whale [38]		Species or species habitat likely to occur within area	In feature area
[Mobula alfredi as Manta alfredi](#) Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In feature area
[Mobula birostris as Manta birostris](#) Giant Manta Ray [90034]		Species or species habitat may occur within area	In feature area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area	In feature area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anous stolidus			
Common Noddy [825]		Species or species habitat may occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In feature area
Fish			
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area	In feature area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area	In feature area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In feature area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area	In feature area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area	In buffer area only
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area	In feature area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area	In feature area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area	In feature area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area	In buffer area only
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area	In feature area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area	In feature area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area	In feature area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area	In feature area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area	In buffer area only
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area	In feature area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area	In feature area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area	In feature area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area	In feature area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area	In feature area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area	In feature area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area	In feature area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In feature area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area	In feature area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In feature area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area	In feature area
Mammal			
Dugong dugon Dugong [28]		Species or species habitat known to occur within area	In buffer area only
Reptile			
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area	In feature area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area	In feature area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area	In feature area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area	In feature area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area	In feature area
Hydrophis coggeri Cogger's Sea Snake [25925]		Species or species habitat may occur within area	In feature area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area	In feature area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area	In feature area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area	In feature area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area	In feature area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area	In feature area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area	In feature area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area	In feature area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area	In feature area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area	In feature area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area	In feature area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area	In feature area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Congregation or aggregation known to occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area	In feature area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area	In feature area

Whales and Other Cetaceans			[Resource Information]
Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area	In feature area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
[Delphinus delphis](#) Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
[Grampus griseus](#) Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
[Megaptera novaeangliae](#) Humpback Whale [38]		Species or species habitat likely to occur within area	In feature area
[Orcaella heinsohni](#) Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area	In feature area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
[Pseudorca crassidens](#) False Killer Whale [48]		Species or species habitat likely to occur within area	In feature area
[Sousa sahulensis](#) Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area	In feature area
[Stenella attenuata](#) Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In feature area
[Tursiops aduncus](#) Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
[Tursiops aduncus (Arafura/Timor Sea populations)](#) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area	In feature area
[Tursiops truncatus s. str.](#) Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area

Habitat Critical to the Survival of Marine Turtles			[Resource Information]
Scientific Name	Behaviour	Presence	Buffer Status
Aug - Sep			
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur	In feature area
May - Jul			
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval	In feature area
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Referral Decision	In buffer area only
Controlled action				
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval	In feature area
Not controlled action				
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed	In buffer area only
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region	Buffer Status
Carbonate bank and terrace system of the Van Diemen Rise	North	In feature area

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence	Buffer Status
Marine Turtles			
Natator depressus			
Flatback Turtle [59257]	Internesting	Likely to occur	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Protected Matters - Print Map - June 12th 2024
Timor Sea
Arafura Sea
25
Darwin
Timor Sea
Tipperary
20 km
10 mi

Appendix E Relevant Persons consultation materials

Preliminary consultation email

Preliminary consultation on Darwin Pipeline Duplication activities covered by:

- **the Darwin Pipeline Duplication Environment Plan (Commonwealth waters) (DPD EP)**
- **the Darwin Pipeline Duplication Construction Environmental Management Plan (Northern Territory coastal waters) (DPD CEMP)**

Overview

Santos is contacting you as we are proposing to undertake Darwin Pipeline Duplication (DPD) activities in:

- Commonwealth waters; and
- Northern Territory coastal waters in an area of NT coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline with a width of approximately 5.5 km.

Under Regulation 11A of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* (Cth) (OPGGS Environment Regulations), in preparing the Environment Plan for DPD activities in Commonwealth waters, Santos is required to consult with relevant persons, which includes:

Commonwealth Departments or agencies to which our proposed activities may be relevant;

- State/Territory Departments or agencies to which our proposed activities may be relevant;
- the Department of the responsible Northern Territory Minister; and
- persons or organisations whose functions, interests and activities may be affected by our proposed activities.

In preparing a Construction Environmental Management Plan for DPD activities in Northern Territory coastal waters under the Northern Territory *Petroleum (Submerged) Lands Act 198*1 (NT PSL) and applied Commonwealth environmental regulations, Santos is required to consult with relevant persons.

You or your department, agency or organisation may be a relevant person for the purposes of the DPD or the DPD CEMP.

A booklet containing information about DPD activities can be found online at www.santos.com/barossa/darwin-pipeline-duplication.

The **DPD Information Booklet** includes information on the proposed activities, potential impacts, risks and management measures and the presence, based on a review of publicly available information, of environmental, social, economic, and cultural features and/or values within the environment that may be affected.

Consultation

Consultation for DPD activities under Commonwealth environmental regulations will commence on **Wednesday 22 November 2023**, with the consultation period closing on **Friday 22 December 2023**.

The DPD activities require approvals under various Commonwealth and Northern Territory legislation, and you may have already had contact with Santos about the DPD activities proposed in NT waters. A summary of the approvals required for the DPD activities can been found in the **DPD - Commonwealth and Northern Territory Approvals Summary**.

Contact

Please contact us at the earliest opportunity if you consider you may be a relevant person to allow time to initiate consultation with you. Also, please let us know if you know of other government Departments, agencies, persons, or organisations which you believe we should consult.

Information provided by you during consultation will be used for the development of the following documents:

- an Environment Plan for the DPD activity in Commonwealth waters, which will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA); and
- a Construction Environmental Management Plan for DPD activity in Northern Territory coastal waters, which will be assessed by the Energy Division within the Northern Territory Department of Industry, Tourism and Trade (DITT).

Seeking information and what's next

At this stage, Santos is seeking information to better understand:

- if you are from a government Department or agency, how the proposed DPD activities may be relevant to your Department or agency; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

If you would like to provide information now, please note that the information you provide will be included in the documentation submitted to NOPSEMA and DITT for assessment. This will include our assessment of the information you provide so that Santos can better understand the environmental risks and impacts from the activities and our response to you.

You can provide feedback via return email or call us toll free on **1800 267 600**.

Please let us know if you would like any particular information you provide to not be published. If requested, Santos will include your information in a separate report which will not be published on NOPSEMA's website. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

Importantly, we recognise that Indigenous people and groups may have concerns about sharing culturally sensitive information so we will follow your guidance when undertaking consultation activities.

Additional resources

NOPSEMA has published information that sets out titleholders' responsibilities for consultation, as well as opportunities for relevant persons to provide guidance for consultation expectations. Click the image to read in full.

We look forward to hearing from you soon.

Regards

Barossa Consultation Coordinator

Email: offshore.consultation@santos.com

Phone: 1800 267 600

Consultation email

Consultation on Darwin Pipeline Duplication activities covered by:

- **the Darwin Pipeline Duplication Environment Plan (Commonwealth waters) (DPD EP)**
- **the Darwin Pipeline Duplication Construction Environmental Management Plan (Northern Territory coastal waters) (DPD CEMP)**

Santos is contacting you as we are proposing to undertake Darwin Pipeline Duplication (DPD) activities in:

- Commonwealth waters; and
- Northern Territory coastal waters in an area of NT coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline with a width of approximately 5.5 km.

Under Regulation 11A of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* (Cth) (OPGGS Environment Regulations), in preparing the Environment Plan for DPD activities in Commonwealth waters, Santos is required to consult with relevant persons, which includes:

- Commonwealth Departments or agencies to which our proposed activities may be relevant;
- State/Territory Departments or agencies to which our proposed activities may be relevant;
- the Department of the responsible Northern Territory Minister; and
- persons or organisations whose functions, interests and activities may be affected by our proposed activities.

In preparing a Construction Environmental Management Plan for DPD activities in Northern Territory coastal waters under the Northern Territory *Petroleum (Submerged) Lands Act 1981* (NT PSL) and applied Commonwealth environmental regulations, Santos is required to consult with relevant persons.

On 9 November 2023, Santos contacted you to advise that consultation for DPD activities under Commonwealth environmental regulations would commence on 22 November 2023 and to seek information as to whether your department, agency or organisation may be a relevant person for the purposes of the DPD or the DPD CEMP.

Consultation

As advised in the email of 9 November, consultation for DPD activities under Commonwealth environmental regulations has now commenced, with the consultation period closing on **Friday 22 December 2023**.

We are seeking information on the environmental values in the operational area and the environment that may be affected by the proposed activities, and the environmental impacts and risks associated with the proposed activities. The information provided by you during consultation will be used for the development of the following documents:

- an Environment Plan for the DPD activity in Commonwealth waters, which will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA); and
- a Construction Environmental Management Plan for DPD activity in Northern Territory coastal waters, which will be assessed by the Energy Division within the Northern Territory Department of Industry, Tourism and Trade (DITT).

You can provide information via return email or call us toll free on 1800 267 600.

Relevant persons being consulted on EPs under the OPGGS Environment Regulations should note that they:

· are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities; and

· are entitled to be allowed a reasonable period for the consultation.

Please note that the information you provide will be included in the documentation submitted to NOPSEMA and DITT for assessment. This will include our assessment of the information you provide so that Santos can better understand the environmental risks and impacts from the activities and our response to you.

Please let us know if you would like any particular information you provide to not be published. If requested, Santos will include your information in a separate report which will not be published on NOPSEMA's website. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

Importantly, we recognise that Indigenous people and groups may have concerns about sharing culturally sensitive information so we will follow your guidance when undertaking consultation activities.

Further information on DPD activities and approvals

The booklet containing information about DPD activities can be found online at www.santos.com/barossa/darwin-pipeline-duplication.

The **DPD Information Booklet** includes information on the proposed activities, potential impacts, risks and management measures and the presence, based on a review of publicly available information, of environmental, social, economic, and cultural features and/or values within the environment that may be affected.

The DPD activities require approvals under various Commonwealth and Northern Territory legislation, and you may have already had contact with Santos about the DPD activities proposed in NT waters. A summary of the approvals required for the DPD activities can been found in the **DPD - Commonwealth and Northern Territory Approvals Summary**.

Additional resources

NOPSEMA has published information that sets out titleholders' responsibilities for consultation, as well as opportunities for relevant persons to provide guidance for consultation expectations. Click the image to read in full.

Seeking information and what's next

During the preliminary consultation phase, Santos sought information to better understand:

- if you are from a government Department or agency, how the proposed DPD activities may be relevant to your Department or agency; and
- what (if any) functions, interests or activities you or your organisation have that may be affected by the proposed DPD activities.

You can still contact us with this information. Also, please let us know if you know of other government Departments, agencies, persons, or organisations which you believe we should consult.

We look forward to hearing from you soon.

Regards

Barossa Consultation Coordinator

Email: offshore.consultation@santos.com

Phone: 1800 267 600

DPD information booklet

Santos

INFORMATION BOOKLET

DARWIN PIPELINE DUPLICATION COMMONWEALTH AND NT COASTAL WATERS ACTIVITIES

INTRODUCTION

The activities described in this booklet relate to the Darwin Pipeline Duplication Project involving the extension of the Barossa Gas Export Pipeline to the Darwin LNG facility. To support this activity, Santos is currently preparing:

- an Environment Plan (EP) relating to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters where offshore petroleum activities are regulated by the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act); and
- an Offshore Construction Environmental Management Plan (EMP) which includes the installation of approximately 8.26 km of the DPD pipeline in an area covered by the *Petroleum (Submerged Lands Act) 1981* (NT) (PSL Act).

The activities described above are more simply referred to in this document as the 'DPD activity'.

ACTIVITY LOCATION

DPD Project activities described in this booklet include those undertaken in Commonwealth waters, approximately 95 km north-west of Darwin and approximately 27 km south-west of the Tiwi Islands (Figure 1) and those undertaken in an area of NT coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline (TSB) with a width of approximately 5.5 km.

Activities will occur within an operational area defined as approximately a 3000 m radius around the pipeline end termination (PLET) and a 2000 m buffer either side of the DPD route. The operational area encompasses the installation of the DPD, as well as the movements of support vessels in the immediate vicinity of the pipelay vessel. Vessels and helicopters within the operational area are considered part of the activity under the DPD EP.

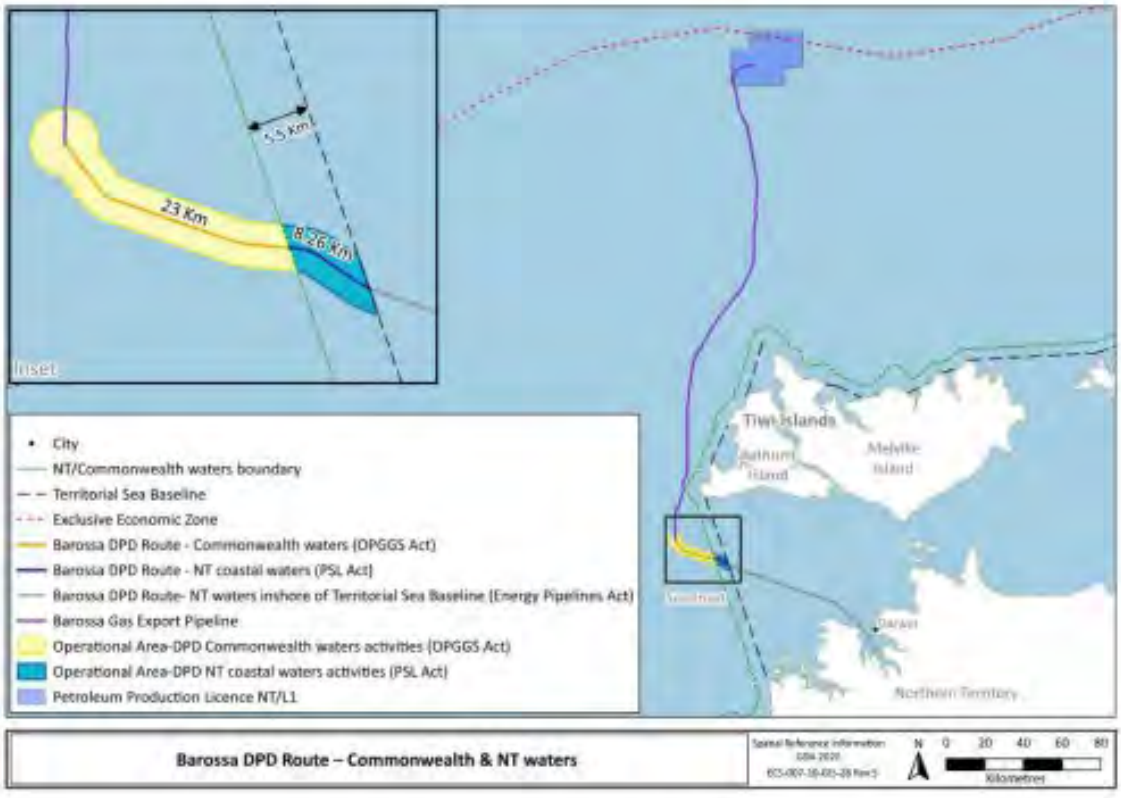


Figure 1: Location of the proposed DPD Route in Commonwealth waters and NT coastal waters

SUMMARY OF ACTIVITIES

The 26 inch stainless steel pipeline with concrete coating will transport natural gas from the Barossa field to the Darwin Liquid Natural Gas (DLNG) plant. A deepwater pipelay vessel will lay the DPD pipeline on the seabed at a rate of approximately 2 to 3 km per day, pending operational performance. A PLET will be installed at the end of the DPD pipeline in Commonwealth waters and a spool will be installed to connect the DPD pipeline PLET to the Barossa Gas Export Pipeline (GEP). Following installation, the DPD pipeline will be pre-commissioned for operations. This will include discharges of pre-commissioning fluids to the marine environment at the PLET in Commonwealth waters.

Helicopter flights to the deepwater pipelay vessel will occur approximately 10 times a week at the peak utilisation, with approximately 70 helicopter movements in total.

This activity is currently planned to commence between Q3 2024 and Q2 2025, subject to obtaining the required approvals but may occur earlier or later due to availability of installation vessels and equipment.

Further to the activity summary above, the list below provides an indicative breakdown of the DPD activity:

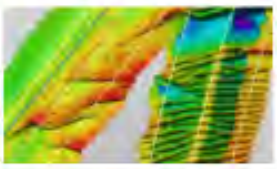
- **Underwater acoustic positioning** - to position equipment and infrastructure underwater
- **Surveys** - to confirm positioning of the DPD, subsea infrastructure and supporting structures
- **Supporting structures installation** - to support or protect the pipeline and associated infrastructure
- **Scour protection and span rectification** - to prevent the movement of sediment around infrastructure and support any pipeline spans
- **DPD pipeline and pipeline end termination (PLET) installation** – in Commonwealth waters (23 km) and 8.26 km of pipeline between the Commonwealth/NT boundary and the TSB
- **Spool installation** - the connection from the DPD pipeline to the GEP
- **Bunkering** - refuelling of pipe-lay and construction vessels
- **Pre-commissioning** - activities to verify the integrity and connections of the infrastructure. Pre-commissioning activities include Flood, Clean, Gauge and Test (FCGT), dewatering and nitrogen filling, and result in fluids (treated seawater and monoethylene glycol (MEG)) that will be discharged to the sea
- **Unplanned and non-routine inspection, maintenance and repairs** - in the unlikely event that damage could have occurred to the DPD infrastructure (e.g. unstable seabed conditions, significant earthquake, cyclone events, anchor strike, dropped objects, and trawl gear interference) inspection, maintenance and repair activities may be required

EQUIPMENT AND VESSELS

The below vessels and equipment will be used to support the DPD installation activities:

- **Pipelay vessel** - the DPD and PLET will be installed using a specialised deepwater pipelay vessel
- **Pipe support vessels (PSVs) and general cargo vessels (GCVs)** - responsible for supply of pipeline to the pipelay vessel
- **Construction and survey vessels** - construction vessels install supporting infrastructure, undertake surveys and support testing and commissioning activities
- **Support vessels** - transport materials, fuel supplies and waste and supplies to and from other vessels
- **Remotely operated vehicles (ROVs)** - to support subsea infrastructure installation and survey
- **Helicopters** – transport to and from the area of operation

Pre-lay survey



Pre-lay span correction
Concrete mattresses are installed at span locations.

Pipe transport
Pipe is loaded onto general cargo vessels at the coating yard in SE Asia and transhipped onto DP pipe supply vessels in sheltered water.

Deep water pipelay and survey
Approximately 23 km of pipeline is installed by a dynamically positioned pipelay vessel. Survey and span correction, if required, is performed as pipelay progresses.

Flood, clean, gauge, testing
The DPD will be flooded and tested with treated seawater before being dewatered and preconditioned.

Spool installation and testing
A spool shall be installed connecting the offshore GEP to the DPD. Once installed the spool will be leak tested.

Figure 2: DPD installation process

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REGIONAL EXISTING ENVIRONMENT SUMMARY

Environment that may be affected (EMBA)

Santos recognises the region's various environmental values and sensitivities. In an EP, it is common to present a geographically defined area of the environment that may be affected (EMBA) by an offshore activity.

Figure 3 depicts the proposed operational area for the activities to be carried out in Commonwealth and NT coastal waters (small highlighted yellow and blue areas) and the EMBA by the proposed activities (orange line). The EMBA represents the greatest geographical extent that could be affected by the unplanned, 'worst case' spill scenario. It should be noted that an actual spill event is more accurately represented by only one of the 300 simulations from the modelling, meaning a much smaller geographical area would be affected in the event of an actual spill. Modelling all these scenarios assists with spill response planning. The EMBA also provides the basis for assessing the range of potential socio-economic risks and establishes a planning area for scientific monitoring.

The Moderate Exposure Value (MEVA) (pink line) is used to inform environmental ecological assessment and identify potential environmental consequences. Beyond the MEVA, environmental impacts and risks are unlikely to result in measurable effects to ecological receptors.

To learn more about spill modelling, exposure values and spill responses, see NOPSEMA Spill Modelling Video.

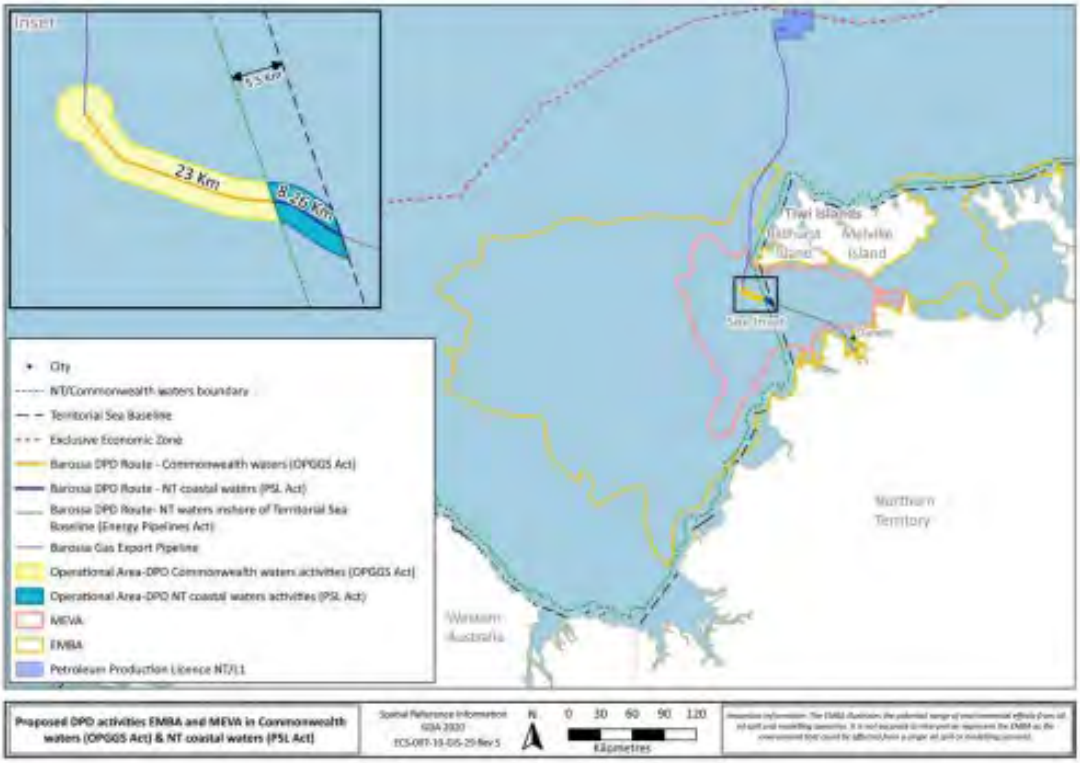


Figure 3: Proposed DPD Activities modelled EMBA and MEVA, in Commonwealth waters covered by the OPGGS Act and NT coastal waters covered by the PSL Act

Below is a summary of known values and significant areas within the EMBA recognised under relevant environmental legislation, including approximate distance from the operational area.

- Oceanic Shoals Marine Park (44km)
- Joseph Bonaparte Gulf Marine Park (185km)
- Garig Gunak Barlu – Marine National Park (230km)
- Cobourg Peninsula – Wetland of international importance (230km)
- Kakadu – World Heritage Areas and wetland of international importance (220km)
- Adelaide River Floodplain System – Nationally important wetland (118km)
- Cobourg Peninsula System – Nationally important wetland (230km)
- Port of Darwin – Nationally important wetland (80km)
- Carbonate bank and terrace system of the Van Diemen Rise – Key ecological feature (5km)
- Pinnacles of the Bonaparte Basin – Key ecological feature (155km)
- Carbonate bank and terrace system of the Sahul Shelf – Key ecological feature (202km)

Regional protected and significant areas

Figure 4, Figure 5 and Figure 6 illustrate the boundaries and zonings of regional marine parks and reserves, key ecological features and wetlands respectively.

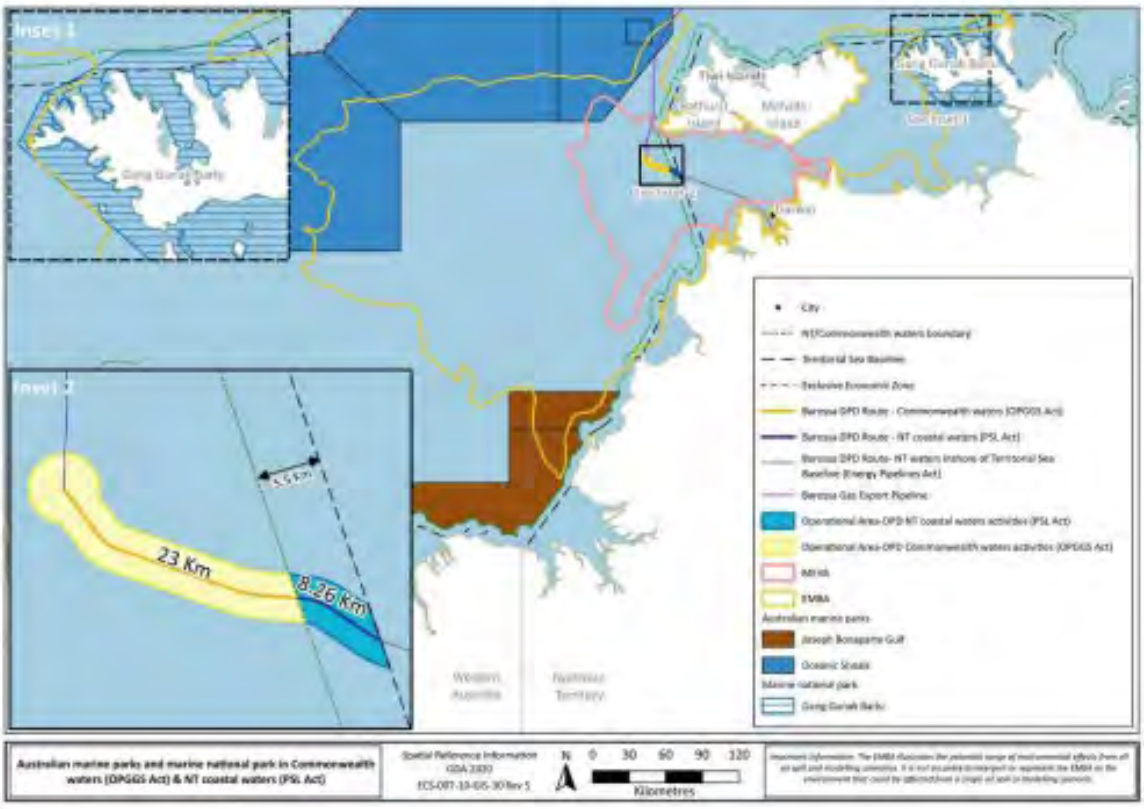


Figure 4: Australian marine parks and marine national park situated within Commonwealth waters covered by the OPGGS Act and NT coastal waters PSL Act

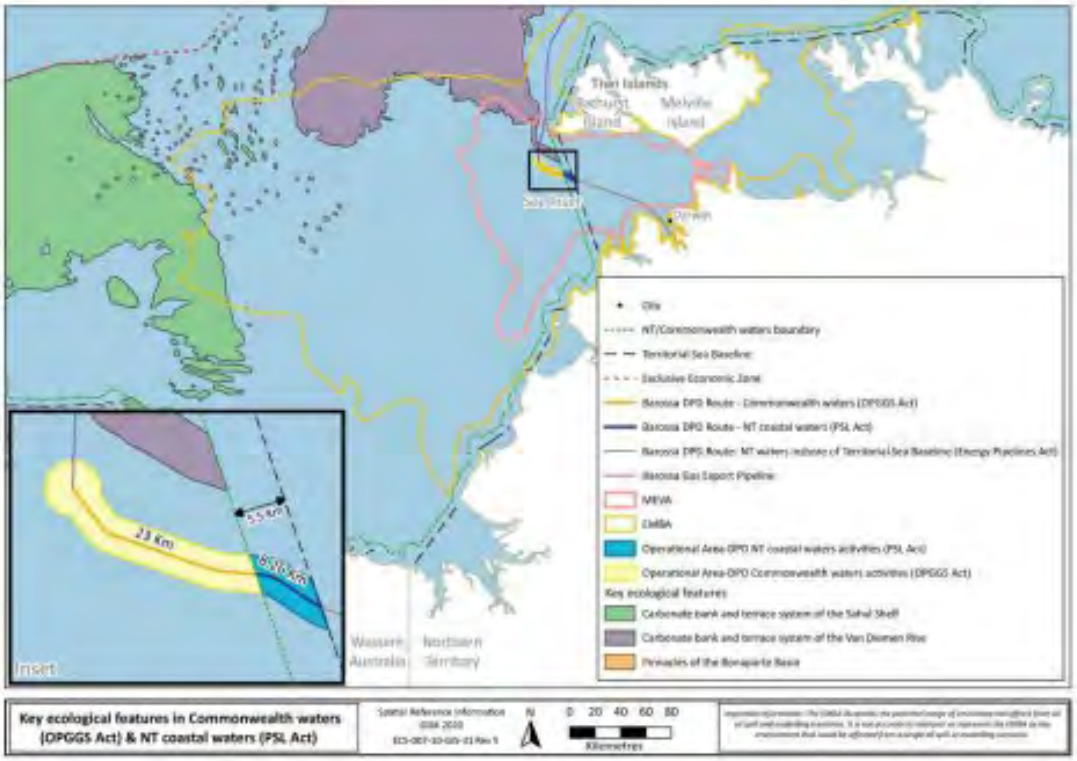


Figure 5: Closest key ecological features to the operational area and EMBA

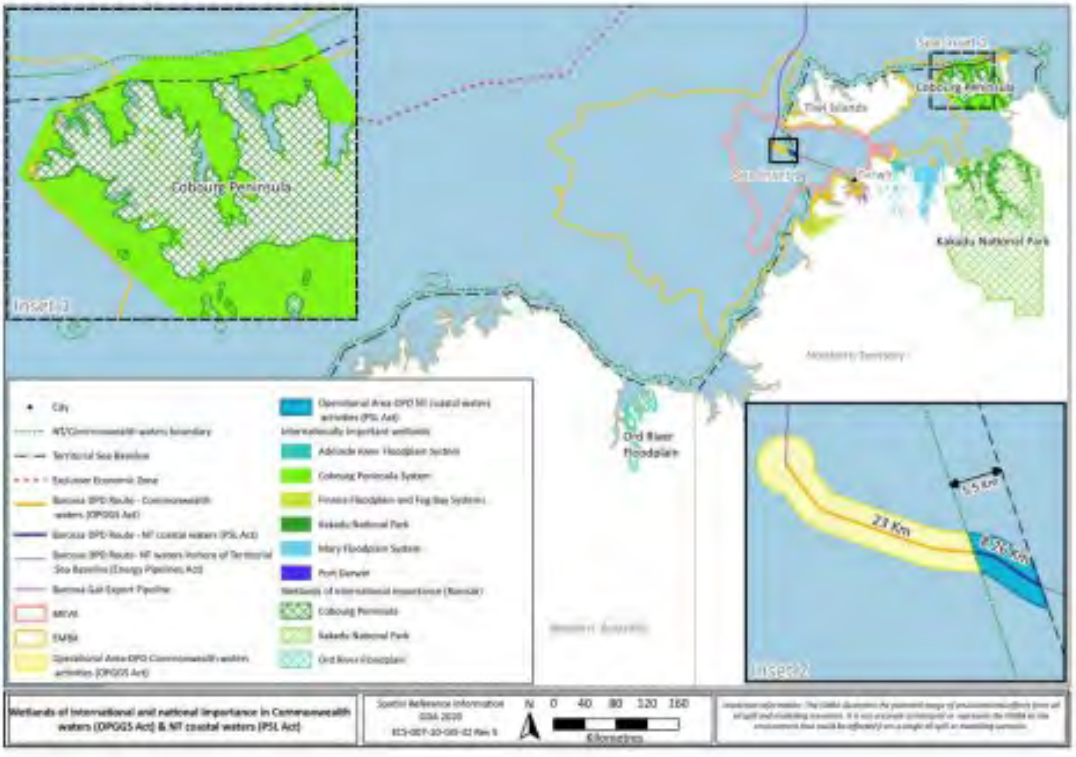


Figure 6: Wetlands of international and national importance

Marine fauna and biologically important areas

Some biologically important areas and habitat critical to the survival of species, occur within the operational area and EMBA. Intersecting the operational area is a flatback turtle internesting biologically important areas, and nesting habitat critical to survival of flatback turtles. Within the EMBA there are biologically important areas for turtles, dolphins, and birds (Figure 7).

DPD activities will be conducted in water depths ranging from approximately 50-60 m where there is a variety of highly mobile marine fauna with a wide distribution that may transit the area in low numbers, such as:

- Bryde's, blue, fin, humpback, killer and sei whales
- Australian humpback, Australian snubfin and spotted bottlenose dolphins
- Alive ridley, green, loggerhead, hawksbill, leatherback and flatback turtles
- Saltwater crocodile
- Sea snakes
- Whale sharks
- Seabirds and migratory shorebirds
- Rays, fish and sharks.

Santos has considered government guidance, including wildlife management plans, recovery plans, conservation advice and threat abatement plans in the development of the EP and is developing control measures to reduce impacts and risks to marine fauna and biologically important areas to as low as reasonably practicable and acceptable.

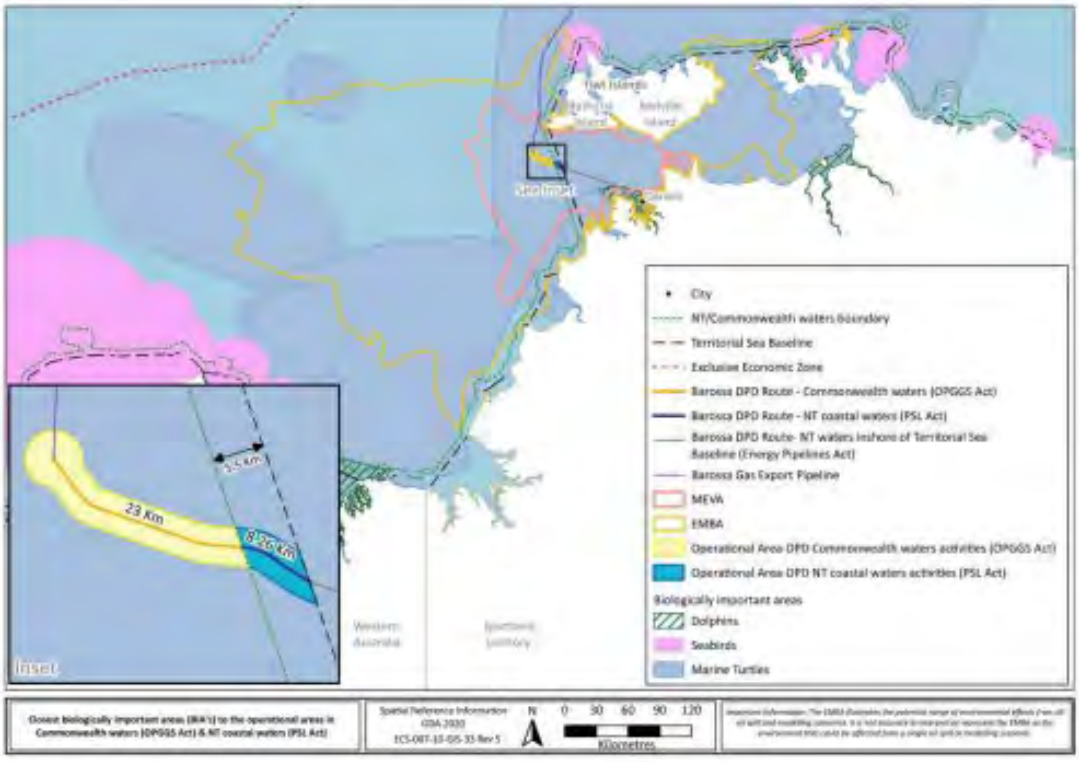


Figure 7: Closest biologically important areas to the operational area and EMBA

REGIONAL SOCIO-ECONOMIC SUMMARY

Socioeconomic activities that may occur in the operational area and EMBA include commercial, recreational and traditional (subsistence) fishing, aquaculture, petroleum industry activities, defence activities, shipping and tourism.

Nearest population centres

The operational area, at its closest point, is located approximately 27 km from Bathurst Island, which is part of the Tiwi Islands. Darwin, is the closest city.

Summary of other uses within the EMBA

Santos' understanding of the uses and values of the area and its strategies to reduce impacts or risks to these uses and values will be informed by consultation. Santos has set out in the list below a summary of the uses and values of the area of which it has knowledge based on existing information or previous consultation. Santos welcomes further information and encourages relevant persons to raise any further uses with Santos.

Commercial fishing

Within the operational area interaction with some commercial fishing is possible. These fisheries include Northern Prawn, Spanish Mackerel, Pearl Oyster, Offshore Net and Line and Demersal. Due to the distance from coastlines and a lack of seabed features that support fish assemblages (including targeted species), the operational area avoids areas of medium and high fishing effort.

Santos has been consulting on various Barossa activities with the relevant fisheries' representative associations, licence-holders and the industry's regulatory bodies over many years.

Tourism, recreational fishing and traditional fishing

The operational area is located in offshore waters that are not likely to be accessed for tourism activities (e.g. charter boat operations) or recreational fishing, as these tend to be centred around nearshore waters, islands and coastal areas. Traditional fishers, as well as recreational fishers, are expected to transit and fish in the EMBA. Some fishers may transit the operational area when travelling between sites.

Shipping

The Darwin Port is Australia's nearest port to Asia and the nation's 'northern gateway' for Australasian trade. There is also a port, Port Melville, located at Garden Point, Tiwi Islands.

Defence Activities

The operational area intersects a defence force practice area, and the EMBA intersects the practice and training areas of the North Australian exercise area and Darwin air weapons range. Australian Border Force vessels may transit through the operational area and EMBA.

Petroleum industry

No established oil and gas operations are located within or in the immediate surrounds of the operational area. There are two existing pipelines within the vicinity of the operational area — the Bayu-Undan to Darwin Pipeline and the INPEX Ichthys pipeline.

Heritage

The EMBA intersects the outer boundary of Kakadu National Park World Heritage Property (Figure 8).

There are no other national heritage places or Commonwealth heritage places within the operational area or EMBA. There are no recorded Aboriginal heritage sites or underwater cultural heritage sites within the operational area. Multiple known shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur within the EMBA. There are several sites that have a declared protected zone or are protected under the NT *Heritage Act 2011* within the EMBA.

Cultural Values

Santos has identified that the Croker Island native title determination (DCD1998/001) partially intersects with the EMBA. The native title holders within the Croker Island native title determination are the Yuwurrumu members of the Mandilarri-Ildugij, the Mangalara, the Murran, the Gadura-Minaga and the Ngaynjaharr clans. The Larrakia native title determination (DCD2006/001) also partially overlaps the EMBA. This determination found that native title does not exist within the claim area.

Santos is aware of Indigenous peoples' connections with Sea Country and is seeking to further identify cultural features and values within the EMBA, including through consultation with Indigenous people and their relevant representative bodies.

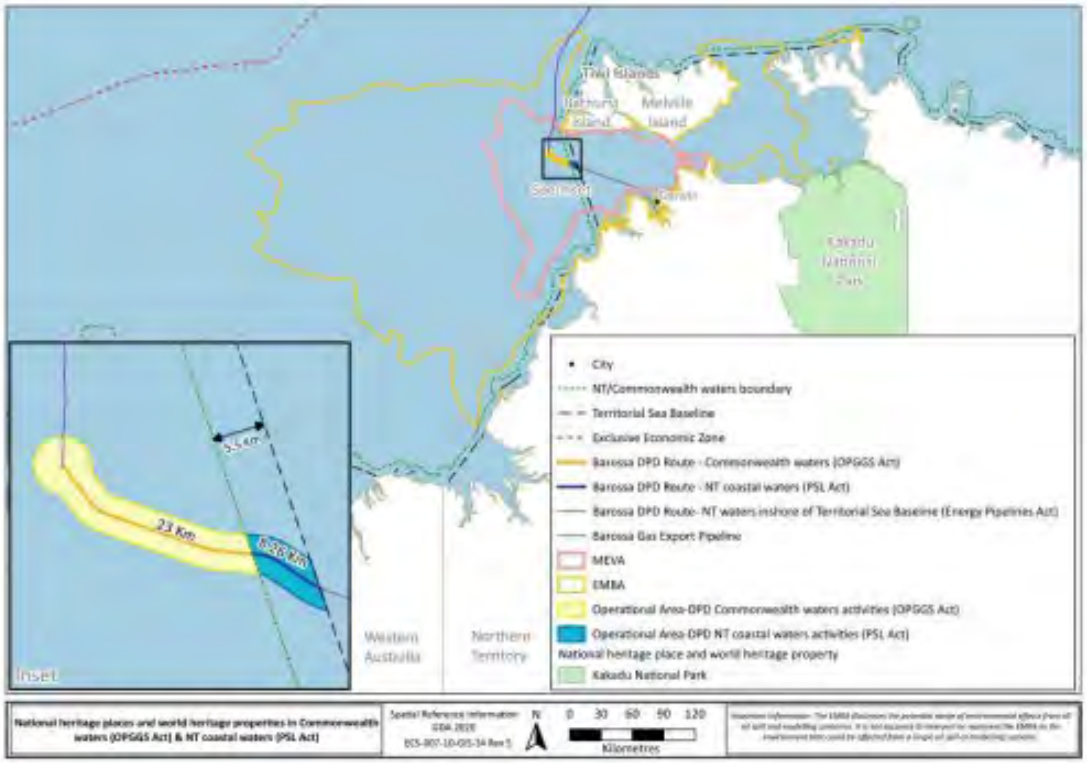


Figure 8: Proximity of the Kakadu National Park World Heritage Property to the operational area and EMBA

SUMMARY OF ENVIRONMENTAL IMPACTS AND RISKS

Environmental impact and risk assessment is the process by which events that will or may occur during an activity are assessed for their potential impacts on or risk to the environment (physical, biological, socio-economic and cultural). They are divided into planned activities and unplanned events.

Planned events are unavoidable impacts, such as light, noise, atmospheric emissions, seabed disturbance, discharges, and interactions with other marine users. Unplanned events are not expected to occur but are planned for to manage risks as contingency measures. They are also assessed based on their likelihood of occurrence. Unplanned events include dropped objects, introduction of invasive marine species, interactions with marine fauna, accidental discharges or spills.

PLANNED ACTIVITIES

The Santos environmental assessment identified the following main potential impacts or risks associated with the planned activities.

Santos proposes to adopt a suite of Santos and contractor systems, procedures and standard control measures to reduce impacts and risks associated with these planned activities to a level that results in a minor or negligible environmental consequence. These consequence levels are considered by Santos to be acceptable and as low as reasonably practicable.

Santos continues to consult on the proposed DPD activities in Commonwealth waters and NT coastal waters to inform its understanding of environmental and cultural values and sensitivities and the assessment of associated impacts, risks and control measures.

NOISE SOURCES

Noise will be generated by activity vessels, helicopters, ROVs, acoustic positioning systems and survey methods. The types of noise generated by DPD activities can be categorised as either impulsive (brief, high intensity), such as acoustic positioning and survey methods or non-impulsive noises (ongoing or continuous) such as vessels.

What impacts are expected?

Studies supporting the assessment indicated that potential temporary impacts to marine fauna are expected to be confined to 9.8 km from the activity vessels, whereas the survey methods and acoustic positioning system are confined within a few hundred meters from the source with no significant impacts at the species population level.

As the total DPD activity has a short timeframe of approximately three (3) months in Commonwealth waters and in NT coastal waters, and the pipelay vessel will only be travelling at 2 to 3 km per day, there is a relatively low probability of encountering significant numbers of noise-sensitive fauna. Transiting marine fauna are expected to demonstrate short-term avoidance behaviour within the operational area. Noise effects to fish of potential commercial value would be restricted to within hundreds of metres of the noise source. No effects to benthic invertebrates are expected, including those of commercial value. Therefore, noise impacts are predicted to be minor, localised and temporary.

How will Santos manage impacts?

Activity vessels are required to comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure to comply with regulatory requirements for managing fauna noise impacts. Marine assurance standards and planned vessel maintenance will minimise noise generated from vessels by ensuring contracted vessels are operated, maintained and crewed in accordance with industry standards and regulatory requirements.

LIGHT SOURCES

Artificial lighting is required for operational and navigational safety during the activity. Light sources include safety and navigational lighting on vessels, spot lighting when needed, such as deploying or retrieving equipment or when ROVs are working underwater.

What impacts are expected?

Light may impact threatened, migratory or local fauna (e.g. marine mammals, marine turtles, sharks, rays, other fish and seabirds) and socio-economic receptors (cultural features).

The vessels are expected to produce similar light levels to other marine vessels in the region. Light modelling indicates that the combined light from the pipelay and construction vessels working together is predicted to reduce to below ambient levels at approximately 21.6 km away.

Combined light may have the potential for behavioural impacts to turtles within 4.5 km. The nearest turtle nesting beaches are approximately 27 km from the operational area. Therefore, nesting habitat or flatback hatchling behaviours are not predicted to be impacted.

Fish may be attracted to artificial light, leading to a short-term localised increase in fauna activity. The activity is assessed as unlikely to impact species abundance or distribution.

Marine mammals are not known to be attracted to light sources at sea. Whales predominantly use acoustic senses rather than visual cues.

How will Santos manage impacts?

Lighting is to be limited to that required for safe operations and navigation and will comply with maritime regulations (similar to other commercial vessels operating in the region). In addition, the pipelay vessel will have an enclosed pipe welding deck which reduces light spill for this activity.

AIR EMISSIONS

Air emissions will occur from:

- fuel combustion to operate vessels and helicopters
- operation of vessel incinerators.

In the offshore environment, air emissions rapidly dissipate into the surrounding atmosphere. Impacts are very localised and not significant. Seabirds and migratory shorebirds are unlikely to be impacted by the localised and temporary reduction in air quality.

How will Santos manage impacts?

Santos proposes to adopt numerous control measures to manage vessel emissions, including requiring contractor vessels' compliance with MARPOL requirements for low-sulphur fuel and air pollution prevention certifications. ('MARPOL' is a reference to the International Convention for the Prevention of Pollution from Ships).

The control measures to be adopted are designed to be consistent with maritime regulations and petroleum industry standards.

Santos has a climate transition strategy and action plan to become a net-zero emissions energy and fuels business by 2040.

SEABED DISTURBANCE

Seabed disturbance will occur because of:

- permanent placement of subsea infrastructure on the seabed (e.g. DPD pipeline and supporting structures)
- temporary placement and set down of equipment and subsea infrastructure on the seabed (e.g. ROV, acoustic positioning transponders, wet-parking equipment)
- temporary disturbance and sediment disturbance during installation.

The total estimated seabed disturbance footprint is approximately 2.36 hectares, approximately half the area of a football field (the MCG playing surface is about 4 hectares). This seabed disturbance area represents a very small portion of the operational area.

The DPD pipeline route intentionally avoids banks and shoals, including Shepparton Shoal. The operational area is predominantly silty, shelly sand with very sparse (<1%) epibiota (mainly soft corals and crinoids).

The activity may cause a temporary increase in water turbidity and will involve equipment directly contacting the sea floor resulting in localised impact to benthic habitat (and associated fauna). As the impacted marine habitats are widespread, the overall ecological impact by this disturbance is not considered to be significant.

internesting BIA and habitat critical for the flatback turtle overlap the operational area. However, due to the operational area water depths (greater than 50 m), the BIA extending over more than 800 km of coastline, and a lack of foraging habitat, the numbers of internesting turtles will be limited hence seabed disturbance is unlikely to affect internesting or foraging turtles..

How will Santos manage impacts?

Santos has attempted to minimise environmental and socio-economic impacts by installing the pipeline parallel and close to the existing Bayu-Undan to Darwin pipeline for most of the pipeline route.

Santos' vessels will undertake activities to enable safe and accurate placement of infrastructure whilst vessels are on dynamic positioning. Santos also intends to maintain an inventory of all installed equipment to enable collection of all equipment during decommissioning (and thus removal of structures to limit ongoing impacts to the seabed.

INTERACTIONS WITH OTHER MARINE USERS

Other marine users that may be in the vicinity of the DPD operational area include commercial fishing, shipping and other incidental marine traffic.

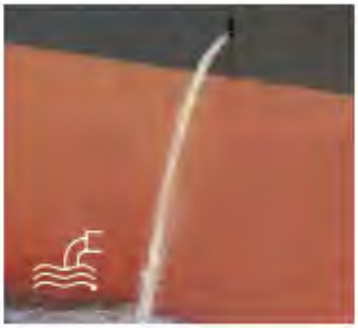
A 500 m cautionary zone will be established around the pipelay and construction vessels to safeguard them during operations.

Helicopter operations will be infrequent (e.g. maximum helicopter movements will be approximately 10 times a week during the peak utilisation period) and at high altitude for most of the route except for landings and take-off, therefore unlikely to interfere with other marine users.

How will Santos manage impacts?

Santos will notify and communicate with other marine users using standard maritime notifications (e.g., Notice to Mariners) and through broadscale and targeted Project updates, before, during and at the end of the activity. Vessels have speed restrictions imposed and automatic identification systems to aid in their detection at sea. Infrastructure locations will be marked on nautical charts. These proposed control measures are designed to be consistent with maritime regulations and industry practices.

The vessels will have speed restrictions imposed of ≤ 8 knots and will use automatic identification systems to aid in their detection at sea. Support vessels are to actively communicate with third-party vessels to inform them of the activities being undertaken. Protection structures will be installed to provide ongoing protection for fishers operating in the vicinity of PLET. Infrastructure locations are to be marked on nautical charts. These proposed control measures are designed to be consistent with maritime regulations and industry practices.



DISCHARGES

Discharges will occur from the proposed DPD pipelay, construction and support vessels during activities.

Vessel discharges

The types of discharges are typical of most offshore commercial vessels and include deck runoff, treated sewage, grey water, machinery cooling water, bilge water (treated via the oily water system), ballast water, macerated food scraps and brine (from water making). These discharges will be small in volume and released into surface waters.

Activity discharges

Potential impacts may occur in the operational area from discharges of treated seawater and monoethylene glycol (MEG - A hydrate inhibitor used to reduce the risk of hydrate formation in infrastructure that could cause a blockage), grout from grout downline flushing and treatment chemicals (biocides, oxygen scavengers, corrosion inhibitors, MEG and dyes).

What impacts are expected?

Vessel discharges

The small volumes of vessel discharges may cause localised nutrient enrichment, organic and particulate loading, ecotoxicological effects, and increased water temperature and salinity around discharge points and in the direction of the current flows. The environment that may be affected by discharges will likely be within approximately 50 m of the activity vessel and likely to be contained within the operational area. Discharges may cause short-term changes to behaviour in marine fauna (avoidance or attraction). For example, fish and seabirds may be attracted to macerated food scraps discharged by vessels.

Activity discharges

Activity discharges are expected to disperse rapidly and be diluted within the operational area. Treated sea water is conditioned with a pipeline testing mixture comprising some additives with specific functions such biocides (to prevent biological activity on the internal surfaces), an oxygen scavenger and corrosion inhibitor (to control internal corrosion of the DPD) and a dye (allows for leaks to be detected through visual inspections).

The hydrotest mixture and MEG additives have been selected and optimised for biodegradability as well as low aquatic toxicity and bioaccumulation potential. Given the low toxicity, and short duration of the activity discharges, there are no significant impacts expected to the transient fauna that may be in the vicinity of the discharge location. Water quality changes are expected to recover within hours to days following cessation of discharges.

How will Santos manage impacts?

Vessel discharges

Vessel discharges are to be managed to acceptable levels as regulated by maritime laws and conventions, such as MARPOL and relevant Australian regulatory Marine Orders.

Activity discharges

Activity discharges are to be managed through the application of Santos's Chemical Selection Process, designed so that environmentally acceptable chemicals (which are likely to be discharged) are selected and used.

Summary of activity discharge types, volumes and duration

Activity	Discharge type	Approximate discharge volume (m3)	Duration of discharge
Flooding	Treated sea water	5,650	Approximately 6 to 12 hours
Hydrotest depressurising	Treated sea water	2,000	
Dewatering	Treated sea water	50,000	Approximately 6 hours
Pre-conditioning	MEG	1,000	Up to 1 day
Spool leak testing	MEG	225	Approximately 1 hour
Grout downline flushing (contingency)	Grout	4	

UNPLANNED EVENTS

Santos uses an environmental assessment guideline to identify, analyse and evaluate incident scenarios (unplanned events). Potential unplanned events have been identified and considered and the associated potential environmental consequences and the event likelihoods (i.e., the risks) have been assessed. Based on the assessment undertaken to support the DPD activity in Commonwealth and NT coastal waters, the following unplanned environmental risks have been identified for this activity:

- dropped objects
- introduction of invasive marine species
- interaction with marine fauna
- treated seawater release
- non-hydrocarbon liquid release
- dry natural gas or nitrogen release
- marine diesel oil release

Santos proposes to adopt a suite of Santos and contractor systems, procedures and standard control measures to seek to reduce the impacts and risks associated with these unplanned events to a level that results in a minor or negligible environmental consequence. These consequence levels are considered by Santos to be acceptable and as low as reasonably practicable.

Santos continues to consult on its DPD activities in Commonwealth and NT coastal waters to inform its understanding of environmental and cultural values and sensitivities, and the assessment of associated impacts, risks and control measures.

DROPPED OBJECTS

There is the potential for objects to be accidentally released to the marine environment from vessels or during installation activities. Objects might include plastics & packaging, PPE, tools & equipment, and installation aids.

What environmental impacts could occur?

Objects that float (Buoyant) could potentially move beyond the operational area. All non-buoyant objects are expected to sink to the seabed and remain within the operational area. This could cause localised and short-term damage to the seabed.

Buoyant objects could potentially move beyond the operational area. In relevant recovery plans and conservation advice, marine debris (including plastics and microplastics) is listed as a potential threat to several marine fauna species. Depending on debris size of the dropped object, there is potential for entanglement or ingestion by marine fauna, including turtles and vertebrate wildlife, which could result in injury or death. However, given the limited quantities that might be dropped, impacts to fauna would be limited.

How will Santos manage the risk?

Santos has numerous control measures to reduce the risk of dropped objects, lost equipment or releasing waste to the environment. These control measures are designed to comply with maritime legislation and include:

- safety standards and procedures to reduce the risk of tools and other equipment being dropped during lifting operations
- waste management procedures to reduce the risk of windblown waste entering the marine environment
- implementation of chemical selection processes and the International Maritime Dangerous Goods Code
- dropped objects, regardless of size, must be reported and attempts made to recover the object according to safety and environment criteria.

INTRODUCTION OF INVASIVE MARINE SPECIES

Invasive marine species are marine flora and fauna that have been introduced into a region that is beyond their natural range but have the ability to survive, and possibly thrive. Many compatible invasive marine species to northern Australia are found in south-east Asian countries. They can be introduced from biofouling on vessels and discharge of ballast water.

If successfully established, invasive marine species can out-compete native species for food or space, prey on native species, impact fisheries or aquaculture, impact on human health through released toxins and cause damage to marine and industrial equipment and infrastructure. There may also be flow-on detrimental effects to marine parks, tourism and recreation.

How will Santos manage the risk?

Vessels contracted to Santos, and vessel ballast, are to be managed according to control measures that comply with maritime regulations, industry practices, and the Biosecurity Act 2015. Vessels will also have ballast water management, vessel biofouling management and anti-fouling systems and measures in place.

INTERACTION WITH MARINE FAUNA

How could interactions with marine fauna occur?

There is the potential for activity vessels, equipment (e.g. ROVs) or helicopters to unintentionally interact with marine fauna, including potential strike or collision, potentially resulting in severe injury or mortality.

What environmental impacts could occur?

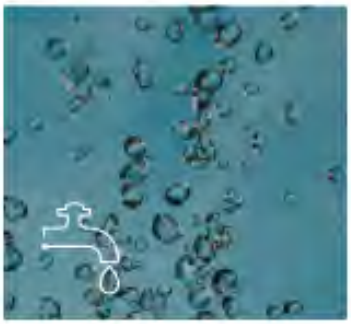
Marine fauna in surface waters that are most at risk from vessel collision include marine mammals, marine turtles and whale sharks. Some of these species are threatened, and some marine fauna may have cultural significance.

The DPD activity will be conducted over a short time period (approximately 3 months). The pipelay vessel travelling slowly (≤1 knot) for up to approximately 2-3 weeks and all other activity vessels will typically be limited to slow speeds. Therefore, the risk of coming into contact with turtles is possible, however, turtles are expected to dive or move away from the vessels.

Marine mammals (such as whales and dolphins) and whale sharks may pass through the operational area in low numbers but there are no known critical habitats or biologically important areas for these species that overlap the operational area. Considering the relatively slow vessel speeds, short duration of activities, and the mobility of these species, it is unlikely that activity vessels will adversely interact with any individuals.

How will Santos manage the risk?

Santos' procedure for interacting with marine fauna, is aligned with the Environment Protection and Biodiversity Conservation Regulations 2000. This procedure limits marine fauna approach distances and speed, allowing marine fauna to be avoided or to move away. It also includes reporting requirements. Vessel speed restrictions, standard operating procedure and crew inductions also supports the management of fauna interactions.



TREATED SEAWATER RELEASE

How could treated seawater be released?

A release of treated sea water (contingency dewatering) may occur as a result of an unplanned wet-buckle (rupture to pipeline wall) or during a stuck pig during FCGT activities or during dewatering operations.

A release of treated seawater may result in impacts to water quality. Actions to address a stuck pug during dewatering operations may also result in the discharge of MEG with the potential to impact environmental receptors.

What environmental impacts could occur?

Any unplanned treated seawater discharges and MEG are expected to disperse rapidly and be diluted within the operational area, with water quality changes expected to recover within hours to days following the cessation of discharges.

How will Santos manage the risk?

Santos has a suite of control measures to manage the risk and impact of treated seawater release. Only environmentally acceptable chemical products are to be used, procedures will be in place to limit the concentration of hydrotest mixture within the treated sea water and differential GPS for pipelay vessels maintains accurate vessel position during installation.

NON-HYDROCARBON LIQUID RELEASE

How could non-hydrocarbon liquids be released?

Non-hydrocarbon liquids including miscellaneous chemicals and waste are used or stored on vessels during the activity. Examples of non-hydrocarbon liquids include brine, cleaning and cooling agents, stored or spent chemicals and leftover paint materials.

An accidental release of chemicals and other non-hydrocarbon liquids into the marine environment has the potential to occur from:

- mechanical failure of equipment, such as tank or pipework failure
- handling and storage spills and leaks due to insufficient fastening or inadequate bunding
- firefighting foam during an unplanned incident

A release of non-hydrocarbon liquids or chemicals may result in impacts to water quality and hence sensitive environmental receptors.

What environmental impacts could occur?

A non-hydrocarbon release could occur from activities such as transferring, storing or using chemical products, mechanical failure of equipment, handling and storage spills, hose or coupling failure or rupture, or tank overfilling.

An accidental release could result in impacts to water quality that are expected to be short term and localised. Potential receptors include the physical environment (e.g. water and sediment quality, benthic habitats), threatened, migratory or local

fauna (e.g. marine mammals, marine reptiles, sharks and rays, other fish, and birds) and socioeconomic features of the environment (including cultural features).

How will Santos manage the risk?

A suite of procedures will be in place to manage the selection, storage, handling and clean-up of chemicals and other non-hydrocarbon liquids. Vessels also have spill response plans. The chemical selection procedure is designed so that only environmentally acceptable chemicals should be used for leak testing and pre-commissioning fluids.

DRY NATURAL GAS OR NITROGEN RELEASE

How could a dry natural gas or nitrogen release occur?

Although highly unlikely, lifting the PLET (foundation, PLET or protection structures) and other DPD activities pose a risk of causing damage to the Bayu-Undan or other Barossa pipelines (NT DPD or GEP if already laid) should an unplanned event occur. Damage could result in a potential rupture that may release dry natural gas or nitrogen into the environment.

What environmental impacts could occur?

Potential receptors include the physical environment (water and air quality); threatened, migratory or local fauna (marine mammals, marine reptiles, sharks and rays, other fish, and birds); socioeconomic (other marine users and cultural features). Potentially the gas cloud may impact air-breathing fauna, such as marine mammals, marine reptiles and birds. Marine mammals, turtles and birds are very unlikely to be affected given the dry natural gas or nitrogen dispersion into the atmosphere, this potential effect would be highly localised (within 500 m of the surface release point) with a short duration and rapidly dispersed within the environment.

Socio-economic receptors

For the Bayu-Undan pipeline release, a gas cloud could form an explosive mix that, if ignited, results in injury/death and property damage. A nitrogen gas cloud could cause asphyxiation at high concentrations. Either gas cloud could risk the health and safety of other users, such as fishers (traditional and commercial), tourism and recreational users. However, all other marine users will be excluded from the construction vessel exclusion zone and, therefore, will not be within 500 m of an event if it occurs.

How will Santos manage the risk?

A thorough set of controls has been proposed to minimise the risk of damage to the Bayu-Undan and Barossa pipelines and related environmental consequences should they occur.

These control measures include implementing standards and procedures for lifting equipment, implementing procedures for lifting over live infrastructure and emergency response procedures implemented to minimise potential for impacts in the event of a loss of containment from the Bayu-Undan Pipeline.

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MARINE DIESEL SPILL

How could a marine diesel spill occur?

Although highly unlikely, a spill could result from a collision between two activity vessels or an activity vessel and a third party. Such a collision could rupture a fuel tank at the sea surface resulting in the release of vessel fuel to the sea. A vessel collision could occur due to factors such as human error, poor navigation, vessel equipment failure or poor weather.

A spill could also occur from a refuelling incident (fuel hose failure or rupture, coupling failure or tank overfilling) where vessel or helicopter refuelling would need to be stopped manually. Fuel released before pumping stops and fuel remaining in the transfer line may be released to the environment.

What environmental impacts could occur?

Spill modelling, based on a worst-case credible scenario (700 m3 release of vessel fuel over 6 hours) indicated (using the moderate exposure value):

- probability of shoreline accumulation was highest during summer conditions, at a maximum of 10%, and lowest during transitional and winter seasons, at 1%. The chance of shoreline accumulation during the summer season only was 3% at Vernon Islands, 1% at Melville Island and 1% at Cox Finniss.
- surface oil was predicted to be limited to within approximately 40 km of the release location
- entrained oil within the water column was predicted to occur within approximately 135 km of the release location
- dissolved hydrocarbons within the water column were predicted within 23 km of the release location.

Potential receptors include the physical environment (water quality, shoals and banks, benthic habitats, shorelines), threatened or migratory fauna (marine mammals, marine reptiles, fish and birds), protected and significant areas, socio-economic receptors (fisheries, tourism, recreation and other third-party operators) and cultural values and sensitivities.

A hydrocarbon release will cause a decline in water quality and may cause chemical (e.g. toxicity) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon release depends on the magnitude of the release (i.e. extent, duration) and sensitivity of the receptor. Given vessel fuel is expected to weather quickly through evaporation and dispersion and is unlikely to persist in the environment, impacts to sensitive receptors are likely to be temporary and localised in nature.

How will Santos manage the risk?

The risk of collision is reduced through controls that manage interactions with other marine users before and during the activity. This includes standard maritime notifications, automatic identification systems and navigational lighting. Cautionary zones will also be in place to manage vessel movements close to activities. Operational procedures are designed to minimise refuelling incidents.

Spill response plans will be in place and regular exercises are planned to be conducted. These control measures are designed to comply with maritime regulations and standard industry practices.

CONTINGENCY SPILL RESPONSE OPERATIONS

In the unlikely event of a hydrocarbon spill, response strategies will be implemented to reduce environmental impacts to as low as reasonably practicable. Response strategies will be undertaken using the Net Environmental Benefits Assessment process. Santos will undertake a 'first-strike' spill response and will act as the control agency until the designated control agency assumes control. The response strategies considered to be appropriate for the worst-case spill scenarios identified for the activity are detailed in the Oil Pollution Emergence Plan (OPEP) specific for the DPD installation activities, and comprise the following potential strategies:

- source control
- monitor and evaluate
- mechanical dispersion
- oiled wildlife response
- scientific monitoring
- waste management.

What impacts are expected?

Spill response operations may be required at any location within the EMBA. Potential environmental impacts include:

- Noise and light emissions – generated by response vessels and equipment which may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals
- Atmospheric emissions - generated from response equipment and vessels are expected to be localised and are not considered to create emissions on a scale where noticeable impacts would be predicted.
- Operational discharges and waste - generated from response equipment and vessels are expected to be consistent with those of normal commercial vessel operations and may create a localised and temporary reduction in marine water quality. Cleaning of oil-contaminated equipment, vehicles and vessels has the potential to spread oil from contaminated areas to areas not impacted by a spill. Sewage and other waste will be generated from offshore activities at temporary staging/mooring areas, which may include toilet and washing facilities. These wastes have the potential to impact water quality, impact habitats, and reduce the aesthetic value of the environment, which may be within protected areas.
- Physical presence and disturbance - operating vessels during spill response operations has the potential to disturb the physical environment and marine habitats and fauna (e.g. vessel strike, behavioural changes) or cause disruption to other marine users, coastal areas, townships and commercial fishing.

How will Santos manage impacts?

Santos will rely primarily on the implementation of the OPEP to manage the potential impacts associated with a spill response event. Other control measures that would be implemented include:

- procedure for interacting with marine fauna
- chemical selection process
- minimum lighting to meet maritime safety and navigation requirements
- air pollution prevention certification
- sewage and oily water treatment systems on vessels
- additional and ongoing consultation with relevant persons
- chemical dispersant application.

SUMMARY OF THE RISK MANAGEMENT STRATEGY

Santos has a management system that includes specific measures, to be used for the duration of the activities under the DPD EP, which seek to confirm that:

- environmental impacts and risks continue to be identified for the duration of the activity are reduced to as low as reasonably practicable and acceptable levels
- control measures are effective in reducing environmental impacts and risks to as low as reasonably practicable and acceptable levels
- environmental performance outcomes and standards set out in the EP are being met
- there will be ongoing appropriate consultation with relevant authorities and other relevant interested persons or organisations
- the roles, accountabilities and responsibilities are defined and understood
- workforce training is completed and competencies assured
- emergency preparedness and response arrangements are in place
- incident reporting, investigation and follow-up is monitored
- audits, inspections, reporting and notifications and document management are appropriately undertaken.

APPROVALS PROCESS

The Commonwealth Government's independent expert regulator for offshore oil and gas development, National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), accepted the Barossa Offshore Project Proposal (OPP) in March 2018.

The DPD Project, specifically the proposed activities in Commonwealth waters, was not included in the Barossa OPP, as the initial intent was to tie the Barossa gas export pipeline directly into the existing Bayu-Undan gas export pipeline. The current intention is to preserve the existing Bayu-Undan pipeline for potential future use to facilitate regional carbon capture and storage. Santos has referred the DPD Project (including the portion of the Project in Commonwealth waters) to the Minister under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The DPD Project was determined to be a 'controlled action' on 6 December 2022. Approval of the DPD Project under the EPBC Act will constitute the government's 'project-level' environmental approval for the Project, with installation and operation of the DPD Project in Commonwealth waters to be subject to acceptance of activity-level EPs by NOPSEMA.

To be accepted by NOPSEMA, an EP must meet the requirements set out in the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS Environment Regulations).

The DPD Project within NT jurisdiction requires primary approval under the *Environmental Protection Act 2019* (NT) (NT EP Act). Following a public comment period, the DPD Project referral under the NT EP Act was determined by the NT Environment Protection Authority (NT EPA) to require assessment by way of Supplementary Environmental Report (SER). The DPD Project SER has been submitted to the NT EPA and has undergone a public comment period. The SER is currently under assessment.

For the DPD activity in NT coastal waters, a DPD Construction Environmental Management Plan (CEMP) will be submitted to the NT Department of Industry Tourism and Trade (DITT) for acceptance under the PSL Act.

In order to meet its proposed schedule for the Barossa Gas Project, Santos is aiming to submit the DPD EP to NOPSEMA and the CEMP to DITT and, subject to regulatory acceptance, to commence activities in 2024. This timeline has been developed by Santos to meet this objective, while still providing a reasonable period for meaningful consultation, having regard to Santos's regulatory obligations and to feedback from relevant persons.

An overview of the various approvals required for the Darwin Pipeline Duplication Project can be found in the Commonwealth and Northern Territory Approvals Summary document.

SEEKING INFORMATION AND WHAT'S NEXT

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose **functions**, **interests** or **activities** may be affected by the activity proposed to be carried out under an EP.

For more information about 'relevant persons' please scan this QR Code:

Relevant persons being consulted on EPs under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (OPGGS Environmental Regulations) should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities;
- are entitled to be allowed a reasonable period for the consultation; and
- may request particular information provided in consultation not be published.

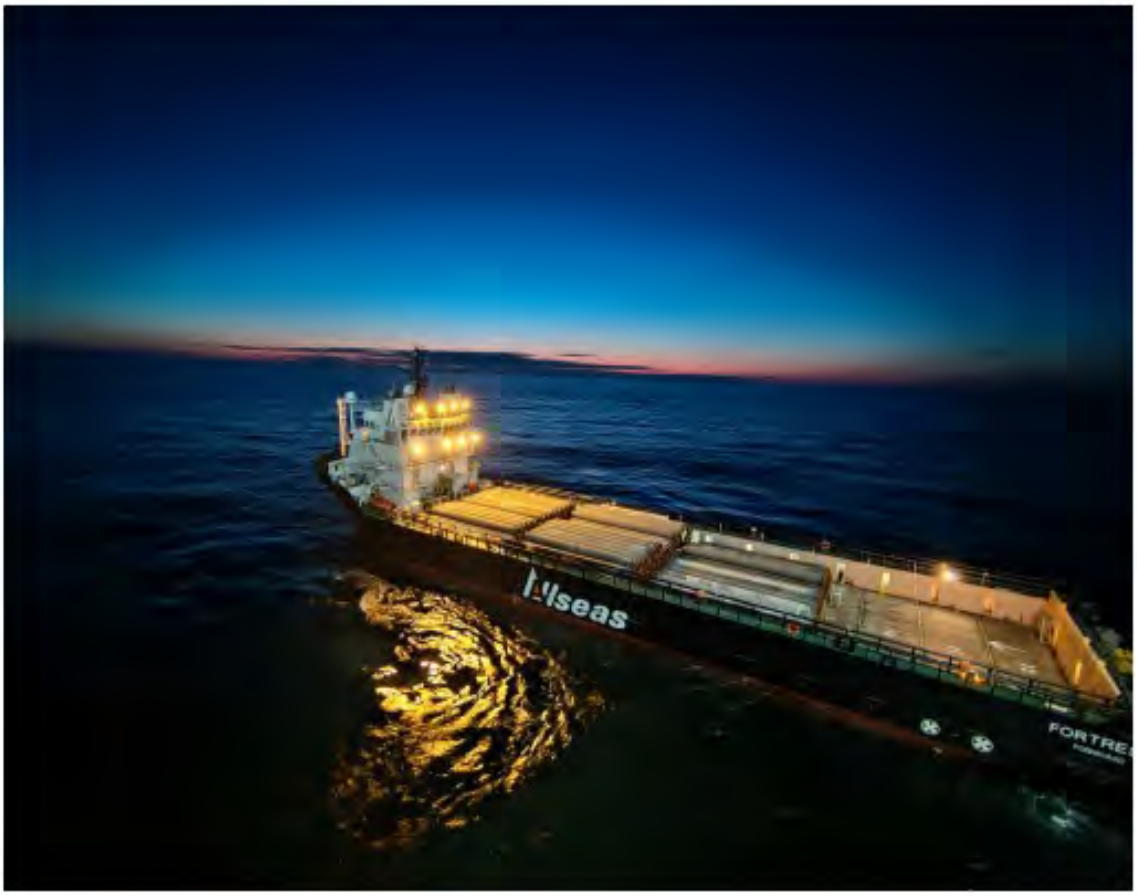
If you do ask this, Santos will respect that, and the information will not be published under the OPGGS Environment Regulations. Information we need to give to NOPSEMA to assess our plan will be provided in a separate report (rather than in the published EP).

Your input is important to Santos:

- so that we can understand the environmental values in the operational area and the environment that may be affected, and the environmental impacts and risks associated with the activity;
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.

If you think you may be a relevant person for the purposes of one of Santos' proposed activities in Commonwealth waters (OPGGS Act) or Northern Territory coastal waters (PSL Act), please contact Santos on **1800 267 600** or email **offshore.consultation@santos.com** to seek to be included in consultations and to provide feedback on how you would like to be consulted (if a relevant person). This can also be done using the form available by scanning the QR Code below:

www.santos.com/barossa/darwin-pipeline-duplication for more information on the Barossa Gas Project.



Further information and links

- DPD Project EPBC Act Referral - https://epbcpublicportal.awe.gov.au/all-referrals/project-referral-summary/?id=08c67f84-cb47-ed11-bba2-00224818a87f
- *Barossa Offshore Project Proposal* https://www.nopsema.gov.au/sites/default/files/documents/2021-03/A598152.pdf
- *Barossa Offshore Project proposal appendices* https://www.nopsema.gov.au/sites/default/files/documents/2021-04/A598152.2.pdf
- NOPSEMA Environment plan content requirements https://www.nopsema.gov.au/sites/default/files/documents/2021-03/A339814.pdf
- NOPSEMA Environment plan consultation requirements https://www.nopsema.gov.au/sites/default/files/documents/Consultation%20in%20the%20course%20of%20preparing%20an%20Environment%20Plan%20guideline.pdf
- NOPSEMA Consultation on offshore petroleum environment plans – Information for the community https://www.nopsema.gov.au/sites/default/files/documents/Consultation%20on%20offshore%20petroleum%20environment%20plans%20brochure.pdf
- Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 https://www.legislation.gov.au/Details/F2023C00107

DPD approval summary booklet

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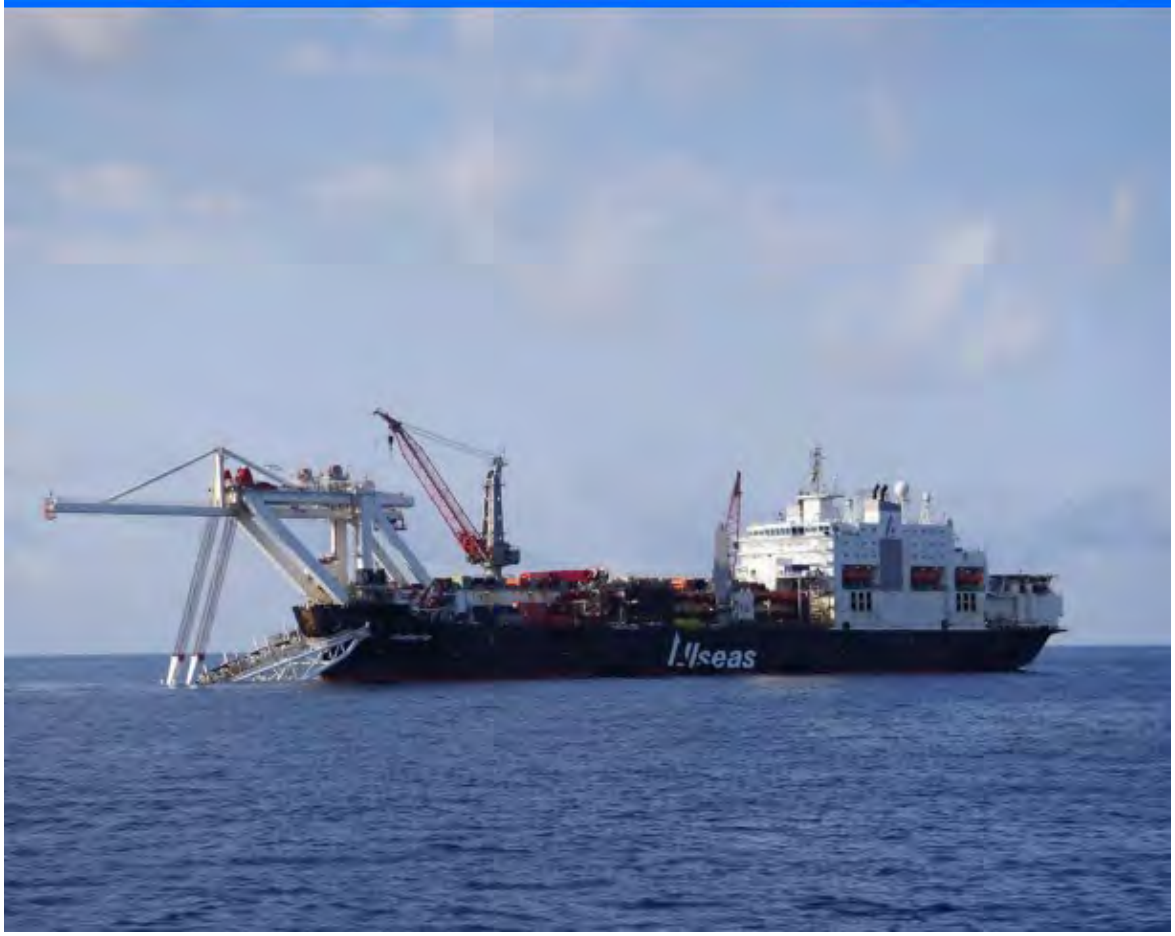
DARWIN PIPELINE
DUPLICATION PROJECT

COMMONWEALTH AND NORTHERN TERRITORY APPROVALS SUMMARY



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Santos is a global energy company committed to helping the world decarbonise to reach net-zero emissions through reliable and affordable energy.

For more than 65 years, Santos has been working in partnership with local communities, providing local jobs and business opportunities, safely developing its natural gas resources, and powering industries and households.

About the Barossa Gas Project

The Santos-operated Barossa Gas Project is an offshore gas and condensate project that proposes to provide a new source of gas to the existing Darwin liquified natural gas (DLNG) facility in the Northern Territory (NT). Natural gas would be extracted from the Barossa field, located in Commonwealth waters approximately 285 kilometres offshore north-north west from Darwin, and transported via the Gas Export Pipeline (GEP) and Darwin Pipeline Duplication (DPD) pipeline to the existing DLNG facility, with first gas targeted for 2025.

Project infrastructure would comprise a Floating Production Storage and Offloading (FPSO) facility, a subsea production system, supporting in-field subsea infrastructure, the GEP and the DPD.

Santos plans to drill six (6) subsea development wells at three (3) drill centres, with contingency plans for an additional two (2) wells. Gas and condensate would be gathered from the wells through the subsea production system and then brought to the FPSO facility via a network of subsea infrastructure.

Initial processing would occur at the FPSO facility, to separate the natural gas, water and condensate extracted from the Barossa field. The dry natural gas would be transported through the gas pipeline for onshore processing at the DLNG facility. Condensate would be transferred from the FPSO to specialised tankers for export.

About the Darwin Pipeline Duplication Project

The DPD Project will extend the Barossa GEP to the Santos-operated DLNG facility and allow for the repurposing of the existing Bayu-Undan to Darwin pipeline to facilitate carbon capture and storage (CCS) options.

Gas from the Barossa field, located approximately 285 kilometres offshore north-north west from Darwin, is intended to replace the current supply to DLNG from the Bayu-Undan facility located in Timor-Leste.

ENVIRONMENTAL APPROVALS FOR DARWIN PIPELINE DUPLICATION

There are various Commonwealth and Northern Territory approvals required for DPD including under the following Acts:

- *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Environment Protection Act 2019* (NT) (Environment Protection Act)
- *Petroleum (Submerged Lands) Act 1981* (NT) (PSL Act)
- *Energy Pipelines Act 1981* (NT) (Energy Pipelines Act)
- *Planning Act 1999* (NT) (Planning Act)

Figure 1 below depicts the approvals required for various sections of the DPD pipeline.

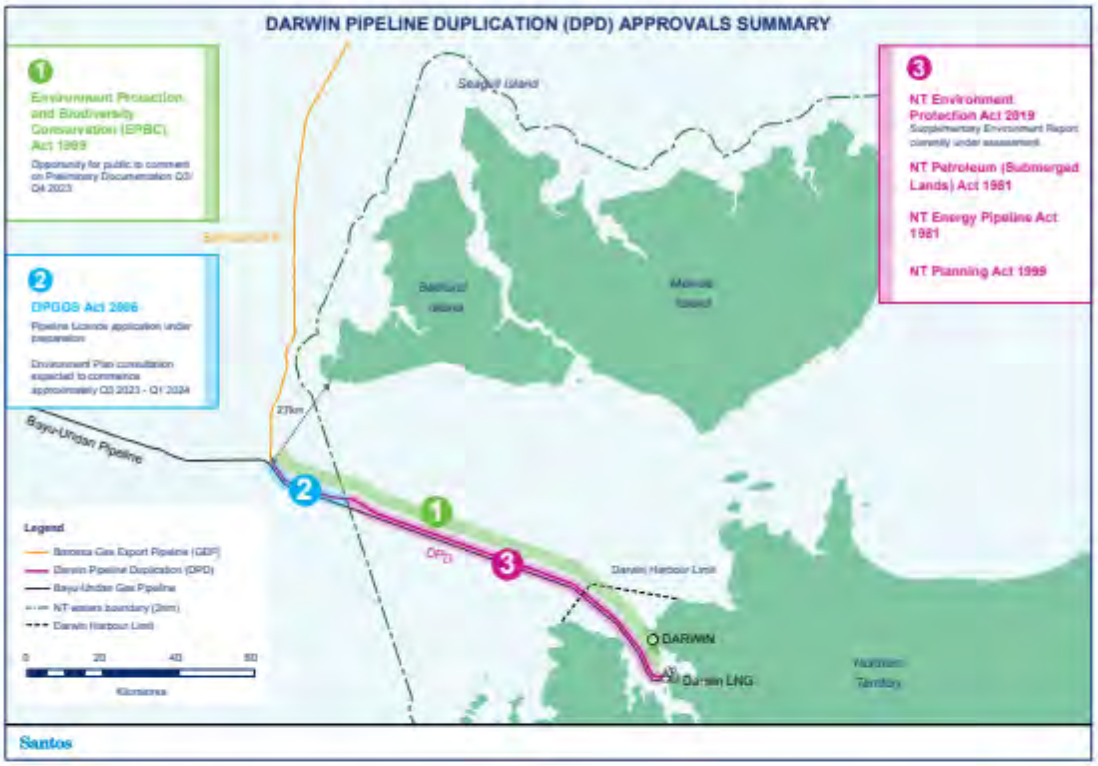

Figure 1. Darwin Pipeline Duplication (DPD) Approvals Summary

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EPBC Act Approval

The DPD Project requires approval under the EPBC Act which will constitute the Commonwealth Government's primary environmental approval of the DPD Project. Following a public comment period, the DPD Project referral under the EPBC Act was determined by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) to be a 'controlled action' on 6 December 2022. This requires the Project to be further assessed by way of Preliminary Documentation, including an additional public comment period.

OPGGS Act Approval

Prior to the installation of petroleum pipelines in Commonwealth waters a pipeline licence is required under the OPGGS Act. Santos has applied to the National Petroleum Titles Administrator (NOPTA) for a licence to cover the DPD pipeline installation and operation in Commonwealth waters.

The DPD Project's installation and operational activities within Commonwealth waters requires acceptance of an activity-level Environment Plan EP by the Commonwealth Government's independent expert regulator for offshore oil and gas development, the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Santos is currently preparing an EP relating to the installation and pre-commissioning of the approximately 23 km long section of the DPD pipeline and supporting subsea infrastructure located in Commonwealth waters. Information about installation and pre-commissioning activities covered by this EP can be found in the **DPD Information Booklet**.

To be accepted by NOPSEMA, an EP must meet the requirements set out in the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (OPGGS Environment Regulations).

In order to meet its proposed schedule for the Barossa Gas Project, Santos is aiming to submit the DPD EP to NOPSEMA and, subject to NOPSEMA's acceptance, to commence activities in 2024. This timeline has been developed by Santos in order to meet this objective, while still providing a reasonable period for meaningful consultation, having regard to Santos's regulatory obligations and to feedback from relevant persons.

Environment Protection Act Approval

The DPD Project within the NT jurisdiction requires environmental approval under the Environment Protection Act. Following a public comment period, the DPD Project referral under the Environment Protection Act was determined by the NT Environment Protection Authority (NT EPA) to require assessment by way of Supplementary Environmental Report (SER). The DPD Project has been submitted to the NT EPA and has undergone a public comment period. The SER is currently under assessment.

PSL Act and Energy Pipelines Act Approvals

Santos has applied for pipeline licences for the DPD pipeline as a requirement under the PSL Act and the Energy Pipelines Act.

Following the granting of pipeline licences as described above, the DPD Project's installation and operational activities within NT waters and land require acceptance of activity-level Environment Management Plans (EMPs) by the NT Government regulator for oil and gas development, the Department of Industry Tourism and Trade (DITT).

Santos will submit an Offshore Construction EMP and an Onshore Construction EMP for the installation and pre-commissioning of the approximately 100 km long section of the DPD pipeline and supporting subsea infrastructure located in NT waters and land. Of the 100 km of pipeline in NT waters, approximately 8.26 km lies within a band of NT coastal waters between the Territorial Sea Baseline (TSB) and the NT/Commonwealth waters boundary. Installation and pre-commissioning activities associated with this section of DPD pipeline are governed by the Energy Pipelines Act. Installation and pre-commissioning activities associated with the remaining section of pipeline (approximately 91.74 km) are governed by the Energy Pipelines Act.

Regulations created under the PSL Act apply Commonwealth environmental regulations to the 8.26 km of the DPD within NT coastal waters. The Commonwealth environmental regulations include requirements for EMP content and activity consultation. Information about installation and pre-commissioning activities covered under the PSL Act can be found in the **DPD Information Booklet**.

Santos is aiming to submit Construction EMPs to DITT, and, subject to DITT acceptance, to commence activities in 2024. This timeline has been developed by Santos in order to meet this objective, while still providing a reasonable period for meaningful consultation, having regard to Santos's regulatory obligations and to feedback from relevant persons.

Planning Act Approval

Santos is required to obtain planning approval under the Planning Act for its DPD Project trenching and spoil disposal activities within Darwin Harbour and for DPD Project installation activities at the Darwin LNG facility. Santos has submitted a Development Permit application and an Exceptional Development Permit Variation application to the NT Department of Planning, Infrastructure and logistics (DIPL) for approval.

Table 1 summarises the approvals required for the DPD Project, and the activity associated with each approval.

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Table 1 Summary of approvals and associated activity[1]

		PRIMARY APPROVAL ASSESSMENT DOCUMENTS			PETROLEUM ACTIVITY EPS/EMPS			DEVELOPMENT PERMITS	
DOCUMENT		Preliminary Documentation Report	Supplementary Environmental Report	DPD EP (Commonwealth)	DPD Offshore Construction EMP (NT)		DPD Onshore Construction EMP (NT)	Development Permit	Exceptional Development Permit Variation
RELEVANT LEGISLATION/ DEPARTMENTAL POLICY		EPBC Act	Environment Protection Act	OPGGS Environment Regulations	Petroleum Submerged Lands Act Environment Protection Act[2]	DITT Policy[4] Environment Protection Act[2]	DITT Policy[4] Environment Protection Act[2]	Planning Act	Planning Act
	ACTIVITY								
Summary Information Booklet	Deep water pipelay;	✓	✓	✓	✓				
	Vessel movements	✓	✓	✓	✓				
	Tie in to PLET	✓		✓					
Fact sheets[3]	Trenching and spoil disposal	✓	✓			✓		✓	✓
	Shallow water pipelay	✓	✓			✓			✓
	Supporting structure installation	✓	✓	✓		✓			✓
	Rock installation	✓	✓			✓			✓
	Shore crossing construction	✓	✓			✓			✓
	Onshore construction	✓	✓			✓	✓		✓
	Pipeline pre-commissioning	✓	✓	✓	✓	✓			✓

[1] Pipeline licences are required under OPGGS Act and NT Petroleum Submerged Lands Act and the NT Energy Pipelines Act.
[2] Construction EMPs are required as conditions of NT Environment Protection Act approval.
[3] Facts sheets with information on topics not covered by the DPD summary information booklet may be developed to provide information on activities in the Northern Territory near shore section of the DPD pipeline.
[4] DITT policy is that the environment management components of the Pipeline Management Plan required under the Energy Pipelines Act are made public in an Environment Management Plan (EMP).

PowerPoint presentation 1

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BAROSSA GAS PROJECT AND BONAPARTE BASIN

DECEMBER CONSULTATION

Barossa
- Darwin Pipeline Duplication (DPD) Environment Plan
- DPD Construction Environmental Management Plan (CEMP)

Bonaparte
- Bayu-Undan Gas Export Pipeline Environment Plan
- Eos 3 Marine Seismic Survey (MSS) Environment Plan
- Tern-2 Plug and Abandonment Environment Plan

WA & NT Environment Plan Consultation

Santos

Acknowledgement of Country

Santos acknowledges the Traditional Owners of the land on which we meet today.

We pay our respects to Elders past, present and emerging.

Privacy Statement

Santos Ltd and its related bodies corporate (together, we, our, us or Santos) collect personal information about you, such as your name and sensitive information about your indigenous heritage. We use this information to record your attendance at any meeting or other discussion with us, to provide you with information about our projects, to receive and respond to any information that you provide, to answer any questions you might have and for other purposes that we tell you about during your meeting or other discussion with us. Santos will handle any information that you provide in accordance with our Code of Conduct and our Confidentiality, IP and Privacy Procedure. You can ask us for a copy of this Privacy Notice or these other documents.

If you do not provide your personal information, we may not be able to identify you as the person who provided particular information or we may be unable to discuss any information you have provided with you further or respond to your questions. We may disclose your information to other companies within the Santos group, to third parties that help us run our business and to relevant government agencies and government departments.

Due to the global nature of our operations and business, your personal information may be accessed by or disclosed to Santos personnel outside Australia. We may also use overseas third parties to collect, transfer, store and handle your personal information. Some of the overseas countries that your personal information may be accessed from, disclosed or transmitted to or stored in include but are not limited to, Papua New Guinea and the United States of America.

You have a right to request a copy of any personal information that we hold about you, as well as a right to request that we correct any information that we hold about you that is inaccurate, out-of-date, incomplete, irrelevant or misleading. You can also make a complaint about how we have handled your personal information. Our Consultation Privacy Policies explain in more detail how you can exercise these rights, including how we will respond to your access or correction request or to any privacy complaint that you make. The Barossa Gas Project Consultation Privacy Policy is available on our website at www.santos.com/barossa/barossa-gas-project-consultation-privacy-policy, and the Western Australia and Northern Territory Consultation Privacy Policy is available on our website at https://www.santos.com/offshore-wa-and-nt-consultation-privacy-policy/. You can also contact us to request copies be provided to you.

You can contact us by:

- posting a letter addressed to us at 60 Flinders Street, Adelaide, South Australia, 5000;
- telephoning us on +61 8 8116 5000; or
- sending us an email at offshore.consultation@santos.com and compliance@santos.com.

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WELCOME AND INTRODUCTIONS

Peter Kirkpatrick

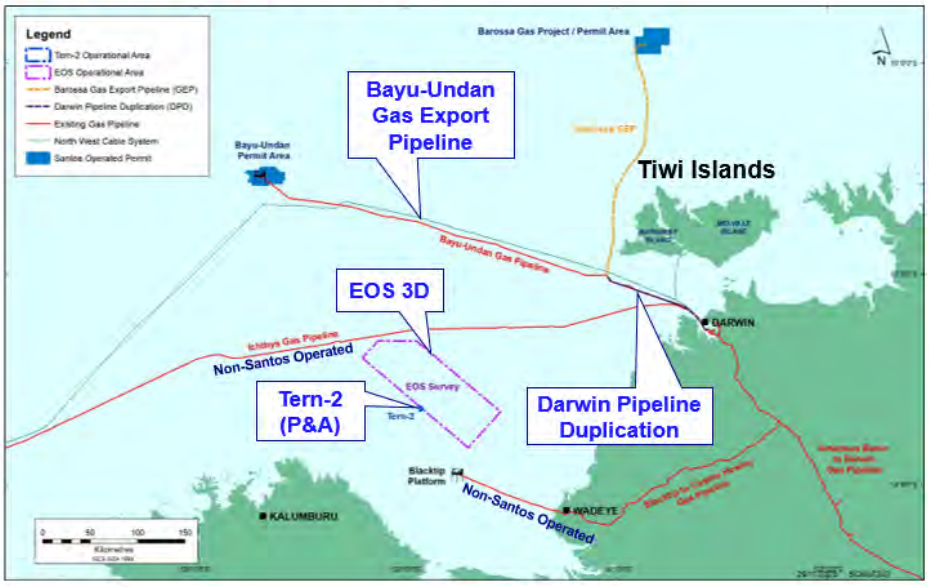
WA & NT Environment Plan Consultation

Welcome & Introductions

We are here today to share information about our company & operations, seek information from you and listen to your questions about Santos & upcoming projects.

- ***Peter Kirkpatrick*** *– General Manager, Darwin*
- ***Tony Johnson*** *- Manager Consultation and Engagement, Offshore*
- ***Lachlan MacArthur*** *– Senior Environmental Adviser*
- ***Carly Sherren*****–** *Senior People Business Partner*
- ***Chris Galway*****–** Barossa Subsea and Pipeline Delivery Manager
- ***Rylan Fabrici*** *– Geoscientist/Business Planner*
- ***Simon Philippides*****–** *Senior Environmental Adviser*

Regional Overview



- Santos is undertaking consultation for the following proposed activities:
  - Darwin Pipeline Duplication
  - Tern-2 Plug and Abandonment (P&A)
  - EOS 3D Marine Seismic Survey
  - Bayu-Undan Gas Export Pipeline Operations

Santos Introductory Video

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BAROSSA DARWIN PIPELINE DUPLICATION CONSULTATION

Chris Galway and Lachlan MacArthur

WA & NT Environment Plan Consultation

DPD Overview

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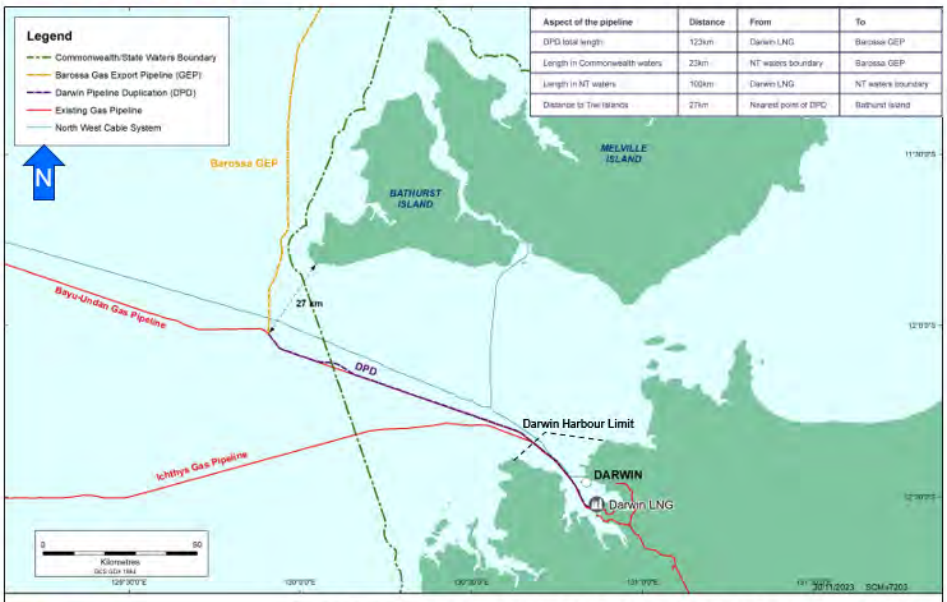

Aspect of the pipeline	Distance	From	To
DPD total length	123km	Darwin LNG	Barossa GEP
Length in Commonwealth waters	23km	NT waters boundary	Barossa GEP
Length in NT waters	100km	Darwin LNG	NT waters boundary
Distance to Tiwi Islands	27km	Nearest point of DPD	Bathurst Island

Barossa Darwin Pipeline Duplication Video

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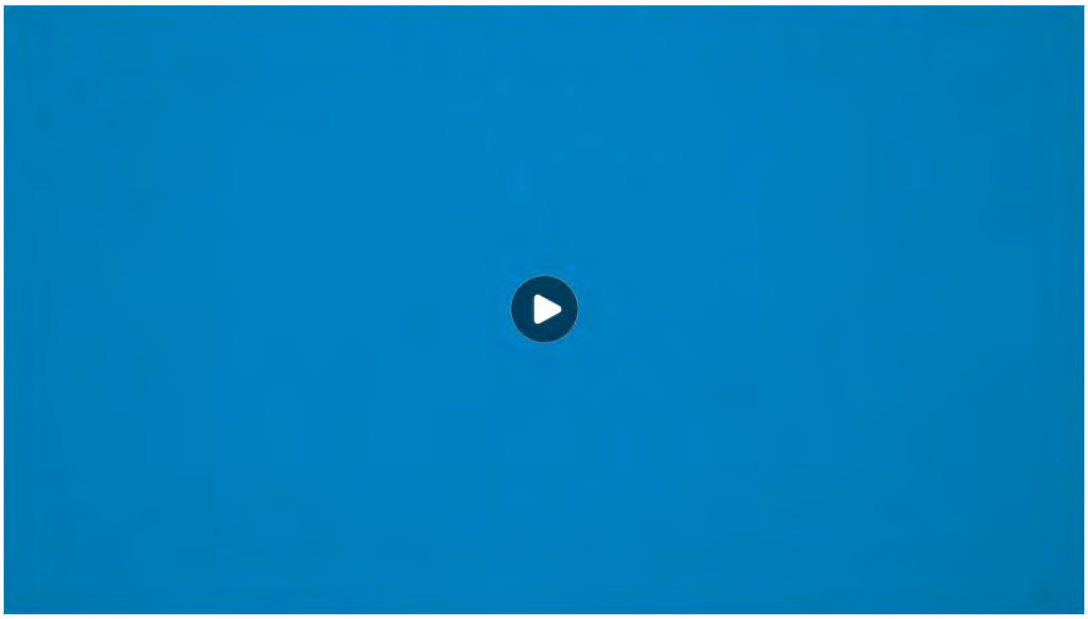

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DPD Installation – Work in Darwin Harbour

The construction activities within Darwin Harbour extend from the gas plant to approximately 30km offshore. Activities include those shown below.

Pre-lay Trenching and Survey

Pre-lay trenching and survey is performed along the pipeline route.

Shallow Water Pipelay

Approximately 30 km of pipeline from shore will be installed using a shallow water anchored barge.

Rock Placement

Rock is installed to protect and stabilise the pipeline.

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DPD Installation – Work Outside Darwin Harbour

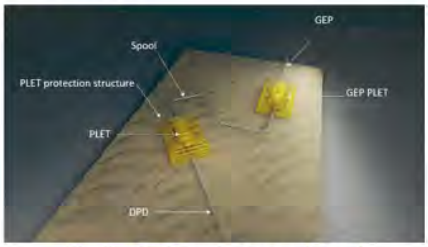
The construction activities outside of Darwin Harbour extend from the harbour limits to approximately 27km south west of the Tiwi Islands. This includes Commonwealth waters and NT Coastal waters

Pipelay Vessel

Survey and Construction Support Vessel

Construction activities include:

- Survey
- Span correction
- Pipeline and structure installation
- Pre-commissioning
- Spool installation



Pipeline End Termination and Spool

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DPD Activity Impacts – Activities Outside of Darwin Harbour

Planned Events	Expected Impact	How we Manage (the rules we follow)
Light disturbance	Behavioural impact to marine life (e.g. attraction) and disturbance to other marine users	We only use lights where needed for safe operations and to comply with relevant safety rules. We turn off lights when not required.
Underwater noise disturbance	Behavioural impact to marine life (e.g. avoidance)	We follow procedures and look out for marine life (e.g. whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. Boats and equipment will be maintained to minimise noise and operated in accordance with Federal requirements.
Seabed disturbance (pipeline and equipment installation)	Temporary increase in turbidity, increasing sedimentation of habitat	We are putting equipment on a mainly flat sandy seabed close to an existing pipeline. We record the position of installed equipment so it can be removed at a later date.
Discharges (boat discharges, pipeline flooding, cleaning, gauging, testing)	Impact to water quality	We will manage discharges to acceptable levels and follow the standard rules for what boats can discharge. We will select chemicals that are environmentally acceptable, and we will limit their use to only what is needed.
Air emissions	Impact to air quality, contribution to national greenhouse gas levels	We ensure engines and other equipment are looked after and low emission fuel will be used.
Disturbance to other boats	Exclude other users from activity area	We will communicate to other boats where we are and what we are doing. We mark the location of equipment on charts.

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DPD Unplanned Risks – Outside of Darwin Harbour

Unplanned Events (Accidents)	Unplanned Impact	How we manage (the rules we follow)
Dropped objects	Impacts to water quality, disturbance to seabed and marine life	We follow strict procedures to stop objects dropping overboard and we pick up objects when it is safe to do so.
Disturbing marine animals	Disturbance (e.g. collisions) to marine animals	We look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. We follow rules that outline how we need to interact with marine animals.
Invasive marine life (marine pests)	Impacts to other marine life and industry if pests establish	We ensure boats have low risk for carrying marine pests before they arrive. We have plans and equipment in place on boats to prevent invasive marine species. The Federal government has strict rules we need to follow.
Chemical spill	Water quality and marine life impacts	We select chemicals that are friendly to the environment where possible and store them carefully. We have procedures for using and cleaning up chemicals.
Gas release (dry gas or nitrogen) - Bayu-Undan pipeline	Impacts to marine life, water/air quality, other marine users and cultural features	We follow strict rules for lifting equipment and have emergency response procedures. We have procedures in place to minimise loss of gas from Bayu-Undan pipeline.
Diesel spill	Impacts to water quality, habitats and marine life, protected areas, other marine users and cultural values/sensitivities	We make sure all the boats are following the rules for preventing collisions. We let other boats know where we are and what we are doing. We follow strict procedures for refueling. We have plans and arrangements in place for responding to spills.

DPD Environment That May Be Affected – Diesel Spill

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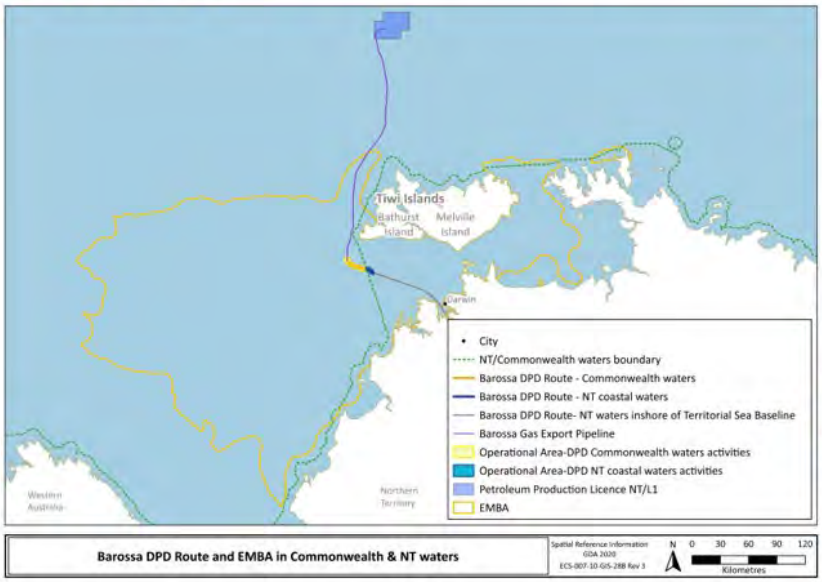

Barossa DPD Route and EMBA in Commonwealth & NT waters

Audacia (pipelay vessel) – 225 m.

700,000 L of diesel is worst case spill

Bulk carrier – 187 m

Cruise ship – 298 m

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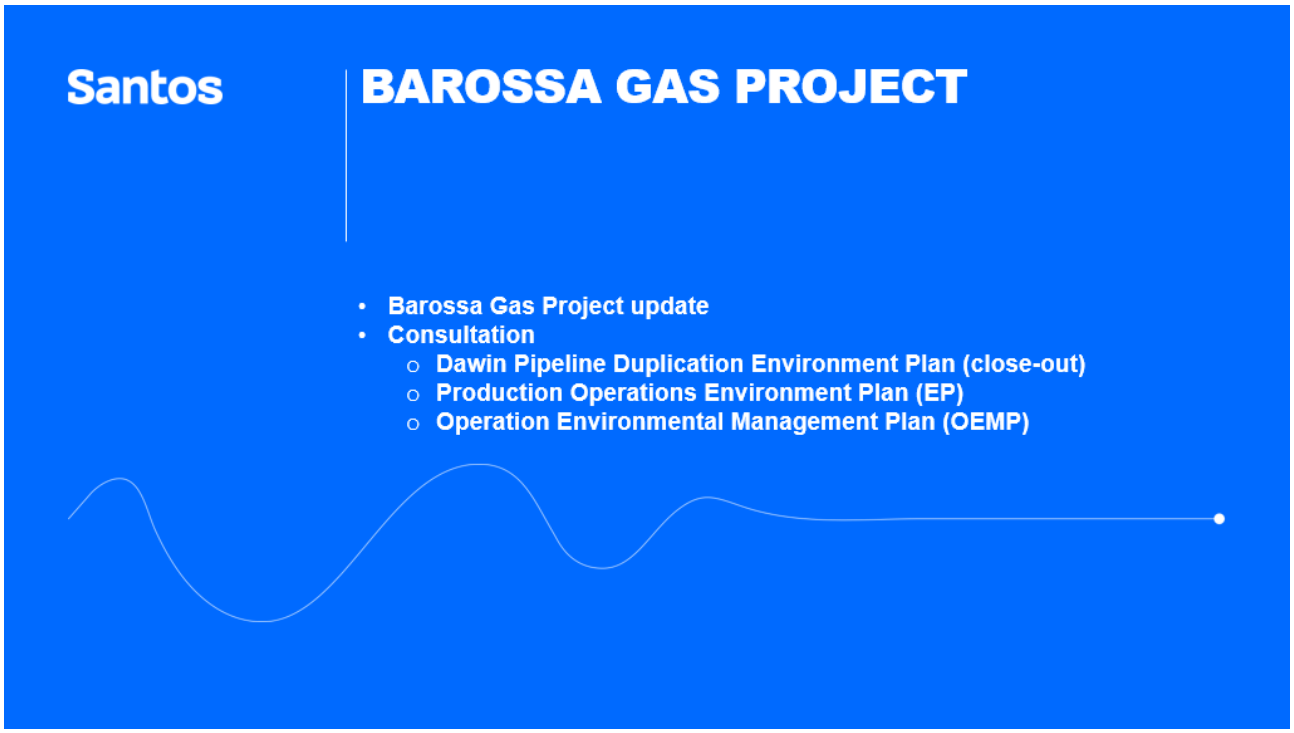
DPD QUESTIONS?

PowerPoint presentation 2



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Acknowledgement of Country

I would like to begin by acknowledging the Traditional Custodians of the land and water on which work, and where we meet today.

We pay our respects to Elders past, present and emerging, and extend that respect to all Aboriginal and Torres Strait Islander peoples here today.

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WELCOME AND INTRODUCTIONS

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Welcome & Introductions

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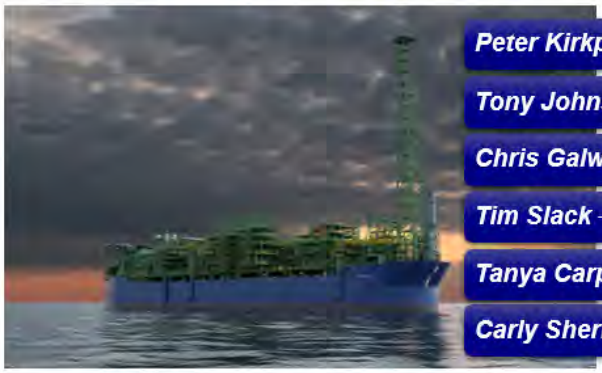

- ***Peter Kirkpatrick*** *– General Manager Darwin*
- ***Tony Johnson*** *– Manager, Stakeholder Engagement & Consultation*
- ***Chris Galway*** *– Barossa Subsea & Pipelines Manager*
- ***Tim Slack*** *– Barossa Offshore Installation Manager*
- ***Tanya Carpenter*** *– Senior Environmental Adviser*
- ***Carly Sherren*** *– Senior People Business Partner*

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SANTOS OPERATIONS & DARWIN LNG

SANTOS - South Australia, Northern Territory Oil Search

Santos is a global energy company committed to increasingly cleaner energy and fuels production, with operations across Australia, Papua New Guinea, Timor-Leste and North America (Alaska).

At Santos, our commitment is to be a global leader in the transition to cleaner energy and clean fuels, by helping the world decarbonise to reach net-zero emissions in an affordable and sustainable way.

For more than 65 years, Santos has been working in partnership with local communities, providing local jobs and business opportunities, safely developing its natural gas resources, and powering industries and households.

Santos is one of Australia's biggest domestic gas suppliers and a leading LNG supplier in the Asia Pacific region.

We are committed to supplying critical fuels in a more sustainable way through decarbonising projects.

Our business focus: Safe, reliable operations & Minimise our social and environmental impacts.

Darwin LNG Facility & Operations

Santos

- Located in Darwin at Wickham Point, Darwin LNG (DLNG) is a single train liquefaction and storage facility that started production in 2006.
- Darwin LNG has shipped its 835th and final LNG cargo from the Bayu-Undan field.
- DLNG generates about $100 million a year in supply and service opportunities for Territory businesses.
- Approx 180 local Darwin people work at the LNG Facility.
- 100% Darwin residential Santos employee workforce.
- DLNG established the NT's first LNG Process Operator Traineeships in 2010.
  - ~10% of those who have completed identified as an Aboriginal or Torres Strait Islander.

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BAROSSA GAS PROJECT OVERVIEW & UPDATE

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Barossa Gas Project Overview Video

Barossa Project Update - Drilling

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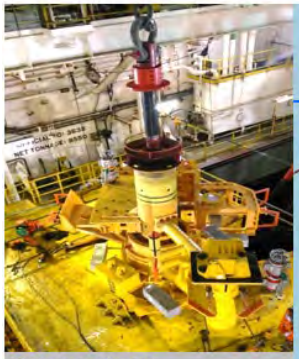
- Drilling recommenced on the 13th Jan.
- Drilling rig towed to the Barossa field and deployed anchors.
- Completed well construction on BR-S2 2 ST1 well.
- Commenced well construction on BR-S2 1A well.



Subsea equipment

Drill bit

Drill floor operations

Derrick structure

Barossa Project Update – SURF & Gas Export Pipeline

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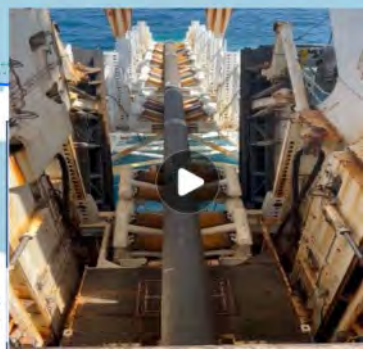


Production Operations Activity - FPSO

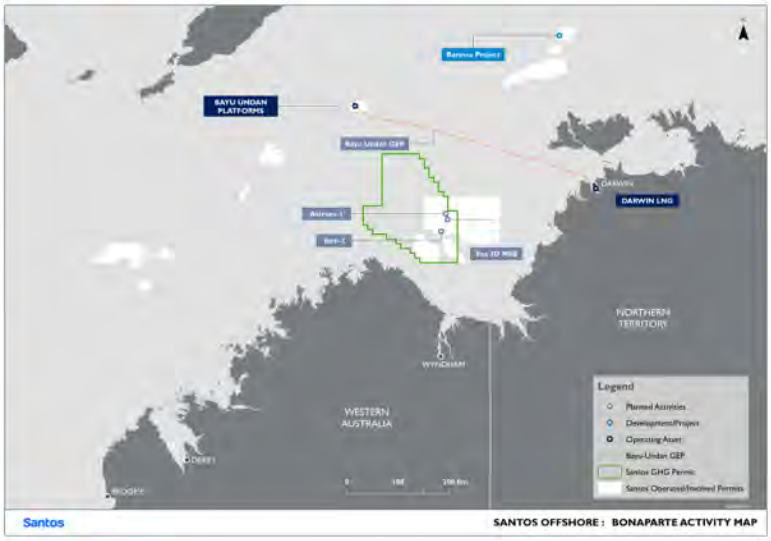
Santos

- Hull has been in Singapore shipyard since late 2023
- Topside process modules which were built in Singapore, are currently being installed along with other construction activities.
- More modules will be added in the next few months.
- Testing and Commissioning activities will take place through to end of year.

Other Santos Activity Update 2024

Santos

Planned Activities	Status
Bayu-Undan Gas Export Pipeline Operations (preservation phase)	Consultation closed. EP under assessment by NOPSEMA.
Tern-2 Plug and Abandonment	Consultation closed. EP under assessment by NOPSEMA.
Eos 3D Marine Seismic Survey	Consultation closed. EP to be submitted to NOPSEMA in Q1 2024.
G-11-AP Carbon Capture and Storage Appraisal Well (Astraea-1)	Consultation closes 20 April 2024. EP submission to NOPSEMA in Q3 2024.



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CONSULTATION SESSION

Consultation – reg 25, *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023* (Cth)

(previously known as reg 11A, *Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2009* (Cth))

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If you do not provide your personal information, we may not be able to identify you as the person who provided particular information or we may be unable to discuss any information you have provided with you further or respond to your questions. We may disclose your information to other companies within the Santos group, to third parties that help us run our business and to relevant government agencies and government departments.

Due to the global nature of our operations and business, your personal information may be accessed by or disclosed to Santos personnel outside Australia. We may also use overseas third parties to collect, transfer, store and handle your personal information. Some of the overseas countries that your personal information may be accessed from, disclosed or transmitted to or stored in include but are not limited to, Papua New Guinea and the United States of America.

You have a right to request a copy of any personal information that we hold about you, as well as a right to request that we correct any information that we hold about you that is inaccurate, out-of-date, incomplete, irrelevant or misleading. You can also make a complaint about how we have handled your personal information. Our Consultation Privacy Policies explain in more detail how you can exercise these rights, including how we will respond to your access or correction request or to any privacy complaint that you make. The Barossa Gas Project Consultation Privacy Policy is available on our website at www.santos.com/barossa/barossa-gas-project-consultation-privacy-policy, and the Northern Territory Consultation Privacy Policy is available on our website at https://www.santos.com/offshore-wa-and-nt-consultation-privacy-policy/. You can also contact us to request copies be provided to you.

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Barossa Darwin Pipeline Duplication Video

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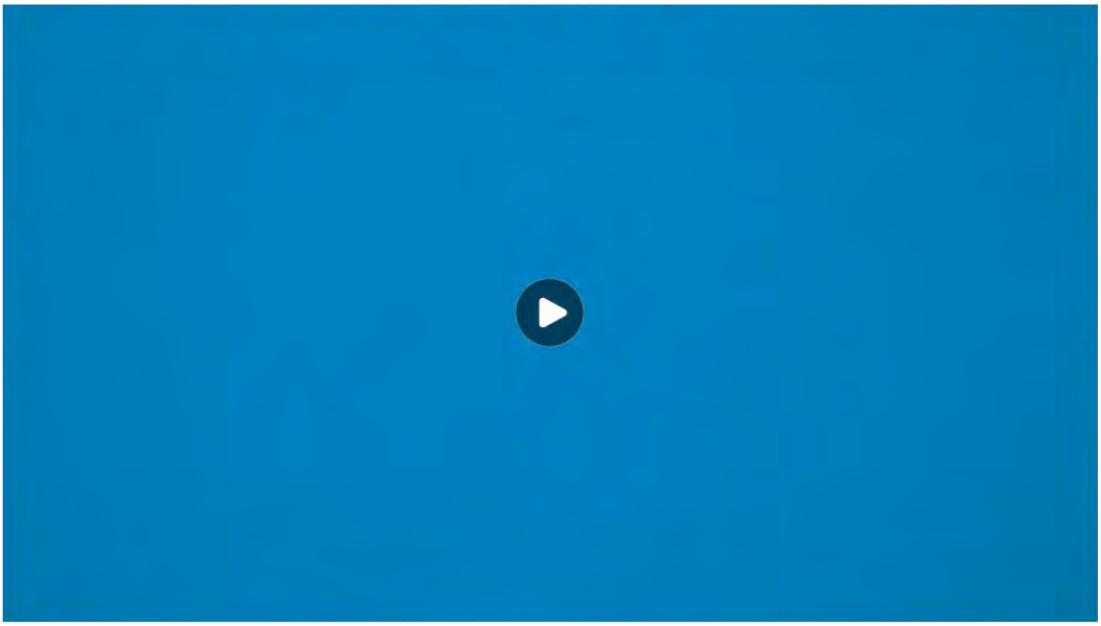
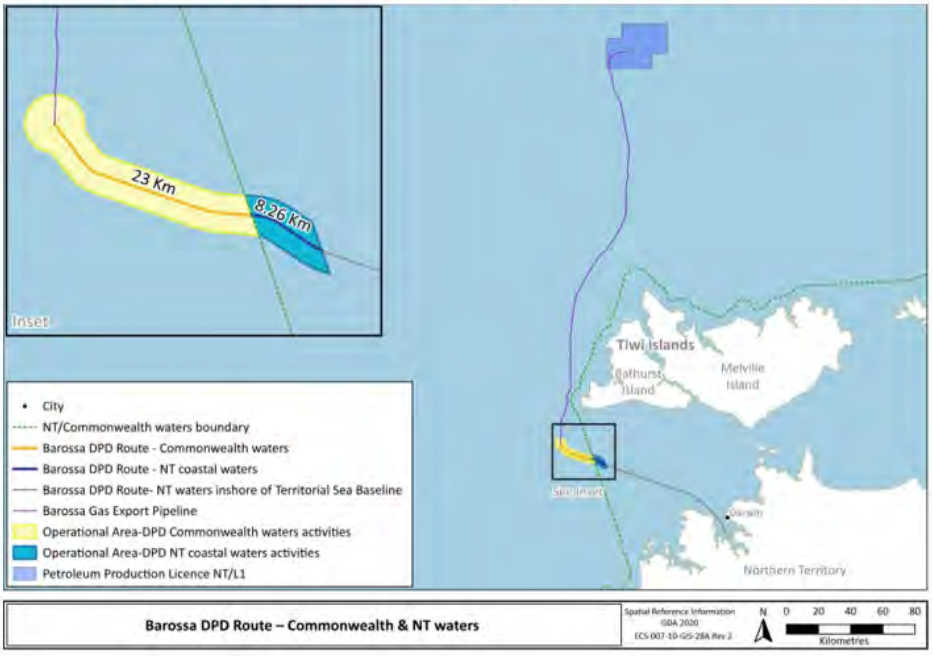


Darwin Pipeline Duplication (DPD) - Overview

Santos

- The DPD will connect to the Barossa gas export pipeline and will send gas to Darwin.
- The pipeline will run from approximately 27km south-west of the Tiwi Islands to the gas plant in Darwin Harbour.
- Activities consist of:
  - survey,
  - pipeline and structure installation,
  - pipeline testing,
  - refuelling,
  - connecting the DPD to the Gas Export Pipeline (GEP) and maintenance/repairs.
  - DPD will be known as the GEP once it is laid and for the purposes of the Production Operations consultation.



Follow Up Questions

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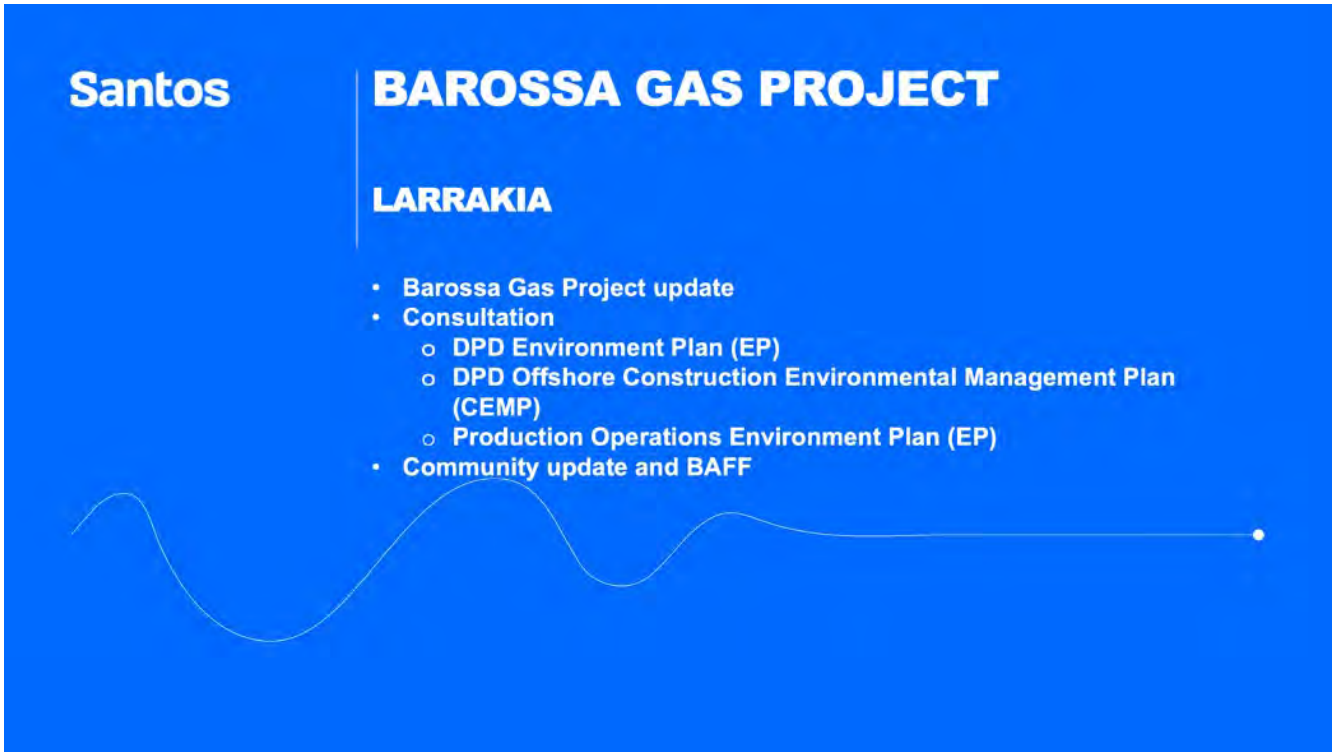
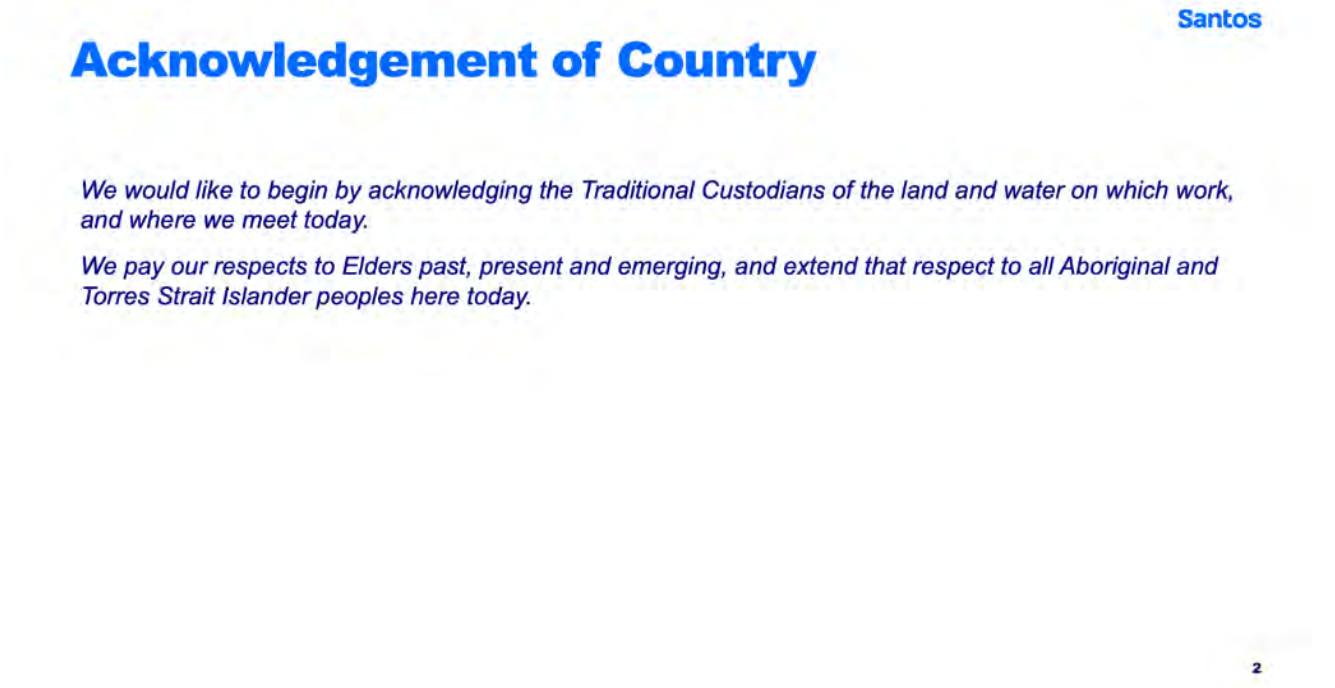
Answers to Questions from Previous Sessions

DPD

1. What is the weight of the DPD pipeline?
2. In what depth of water will the DPD pipeline be laid?
3. What are the chemicals used during DPD pre-commissioning activities?
4. Can the DPD seabed survey be shared?
5. Can we have a copy of DPD activity impacts table?
6. Can Cultural Observers and Monitors provide feedback directly to Tiwi people at the end of their shift?

PowerPoint presentation 3





What we'll cover today

- Overview of the Barossa Project
- Quick review of other work Santos is doing in the region.
- **Darwin Pipeline Duplication (DPD) Consultation**
  - **Activity Impacts and Risks and close-out**
- **Barossa Production Operations Consultation**
  - **Close-out**
- Community updates – employment and training
- The Barossa Aboriginal Future Fund

Please ask questions – and tell us if we aren't being clear!

Welcome & Introductions

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Peter Kirkpatrick *– General Manager, Darwin*

Angelina Anictomatis *– Manager, Community Affairs NT*

Neil Pomfret *– First Nations Engagement Advisor*

Kim Brewster *– Community Adviser, NT*

Lachie MacArthur *- Senior Environmental Adviser*

True North *– Meeting minutes and support*

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BAROSSA GAS PROJECT OVERVIEW & UPDATE

Santos

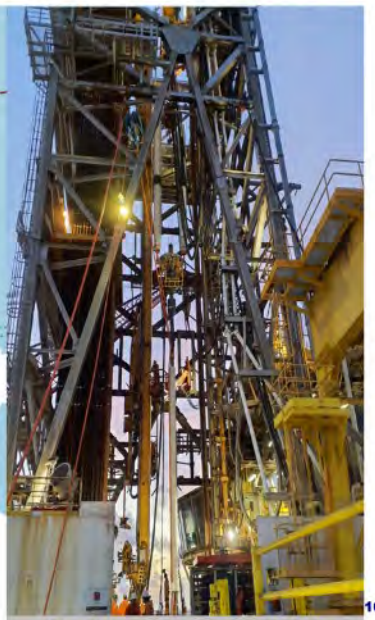
Barossa Gas Project Overview Video

Barossa Project Update

Santos

- The drill rig has finished drilling the second well to just above the reservoir and installed plugs.
- The was moved to the next drilling position and has started drilling the third well.

Installing the Wellhead



Derrick structure on drill rig

Barossa Project Update

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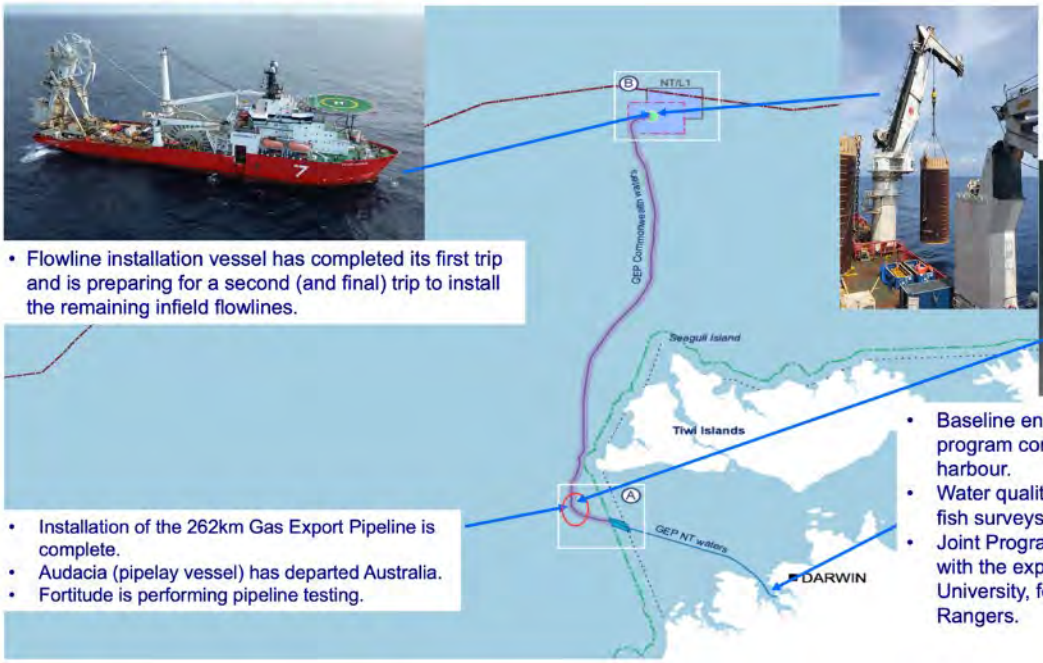
- Flowline installation vessel has completed its first trip and is preparing for a second (and final) trip to install the remaining infield flowlines.



- Hook-up of the buoy and moorings is completed.
- Vessel is preparing for riser and umbilical installation.

- Installation of the 262km Gas Export Pipeline is complete.
- Audacia (pipelay vessel) has departed Australia.
- Fortitude is performing pipeline testing.

- Baseline environmental monitoring program completed around Darwin harbour.
- Water quality, habitat monitoring & fish surveys
- Joint Program funded by Barossa with the expertise of RPS, Curtin University, focus subsea, Larrakia Rangers.

Barossa Project Update

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- Construction activities continue in Singapore Shipyard.
- Ongoing installation of modules and large process equipment on FPSO.
- ROV survey of hull for marine biofouling complete and a report will be prepared with that data.

Barossa Project Update – SURF & Gas Export Pipeline

Santos

The installation of the 262km long Gas Export Pipeline is complete and pipeline testing in ongoing.

Other Santos Activity Update 2024

Santos

Planned Activities	Status
Bayu-Undan Gas Export Pipeline Operations (preservation phase)	Consultation closed. EP under assessment by NOPSEMA.
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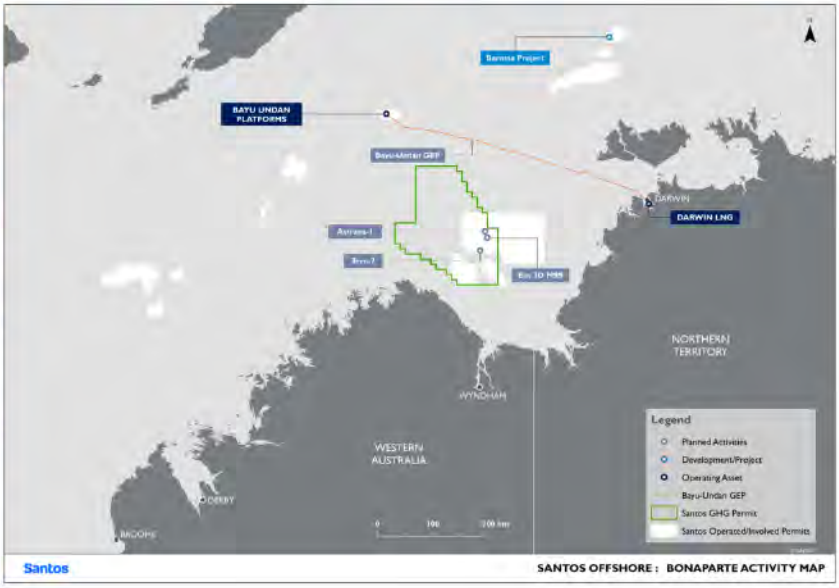

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BAROSSA DARWIN PIPELINE DUPLICATION COMMONWEALTH AND NT COASTAL WATERS

Barossa Darwin Pipeline Duplication Video

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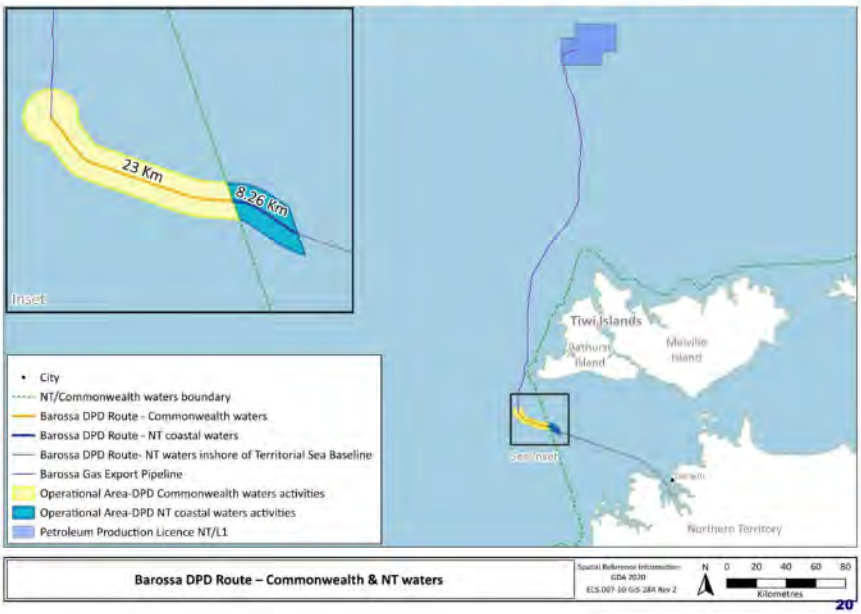
Darwin Pipeline Duplication (DPD) - Overview

Santos

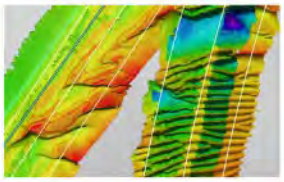
- The DPD will connect to the Barossa gas export pipeline and will send gas to Darwin.
- The pipeline will run from approximately 27km south-west of the Tiwi Islands to the gas plant in Darwin Harbour.
- **We are consulting on the installation of 23 km of pipeline in Commonwealth waters (approx. 95 km NW of Darwin) and 8.26 km of pipeline in NT coastal waters (approx. 80 km NW of Darwin)**
- Activities consist of acoustic positioning, survey, pipeline and structure installation, pipeline testing, refuelling, connecting the DPD to the Barossa gas export pipeline and unplanned maintenance/repairs.
- DPD activities in Commonwealth and NT coastal waters are currently planned to start between Q3 of 2024 and Q2 of 2025, depending on availability of vessels and equipment, and should last 3 months)



Key DPD Installation Steps (Commonwealth and NT coastal waters)

Santos

Pre-lay Survey



Pre-lay Span Correction

Concrete mattresses are installed to support the pipeline where the seabed is rough.

Pipelay and Survey

Approximately 31km of pipeline is installed in Commonwealth and coastal waters by a pipelay vessel. Survey and post lay span correction, if required, is performed as pipelay progresses.

Pipeline Testing

The DPD will be flooded with treated seawater and leak tested before the water is removed and the DPD is prepared for introduction of gas.

Connect DPD to the Gas Export Pipeline and Test

A spool shall be installed connecting the offshore gas export pipeline to the DPD. Once installed the spool will be leak tested.

DPD Installation Activities – Key Vessels

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Pipelay Vessel (Audacia)

Survey and Construction Support Vessel (Fortitude)

Supply Vessel

DPD impacts

Santos

Planned events	Expected Impact	How we manage (the rules we follow)
Light disturbance	Behavioural impact to marine life (e.g. attraction)	We only use lights where needed for safe operations and to comply with relevant safety rules. We turn off lights when not required.
Noise disturbance	Behavioural impact to marine life (e.g. avoidance)	We follow procedures and look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. Boats and equipment will be maintained to minimise noise.
Seabed disturbance	Turbidity, smothering of habitat	We are putting equipment on a mainly flat sandy seabed close to an existing pipeline. We record the position of installed equipment so we can collect it at a later date.
Discharges (boat discharges, pipeline testing)	Impact to water quality	We will manage discharges to acceptable levels and follow the standard rules for what boats can discharge. We will select water treatment chemicals that are environmentally acceptable, and we will limit its use.
Air emissions	Impact to air quality, greenhouse gas emissions	We ensure engines and other equipment are looked after and low emission fuel will be used.
Disturbance to other boats	Exclude other users from activity area	We will communicate to other boats where we are and what we are doing. We mark the location of equipment on charts.

DPD risks

Santos

Unplanned events (Accidents)	Unplanned Impact	How we manage (the rules we follow)
Dropped objects	Impacts to water quality, disturbance to seabed and marine life	We follow strict procedures to stop objects dropping overboard and we pick up objects when it is safe to do so.
Disturbing marine animals	Disturbance (e.g. collisions) with marine life	We look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. We follow rules that outline how we need to interact with
Invasive marine life	Impacts to other marine life and industry	We inspect the boats to ensure no invasive marine life before they arrive. We have plans and equipment in place on boats to prevent invasive marine species. The Federal government has strict rules we need to follow.
Chemical spill	Water quality impacts	We select chemicals that are friendly to the environment where possible and store them carefully. We have procedures for using and cleaning up chemicals.
Gas release (dry gas or nitrogen) - Bayu-Undan pipeline	Marine life impacts, other user impacts	We follow strict rules for lifting to prevent dropped objects. We have procedures in place to minimise loss of gas from Bayu-Undan pipeline.
Diesel spill	Water quality, impacts to habitats and marine life, protected areas, socio-economic and cultural values	We make sure all the boats are following the rules for preventing collisions. We let other boats know where we are and what we are doing. We follow strict procedures for refueling. We have plans and arranegments in place for responding to spills.

DPD Environment That May Be Affected – Diesel spill

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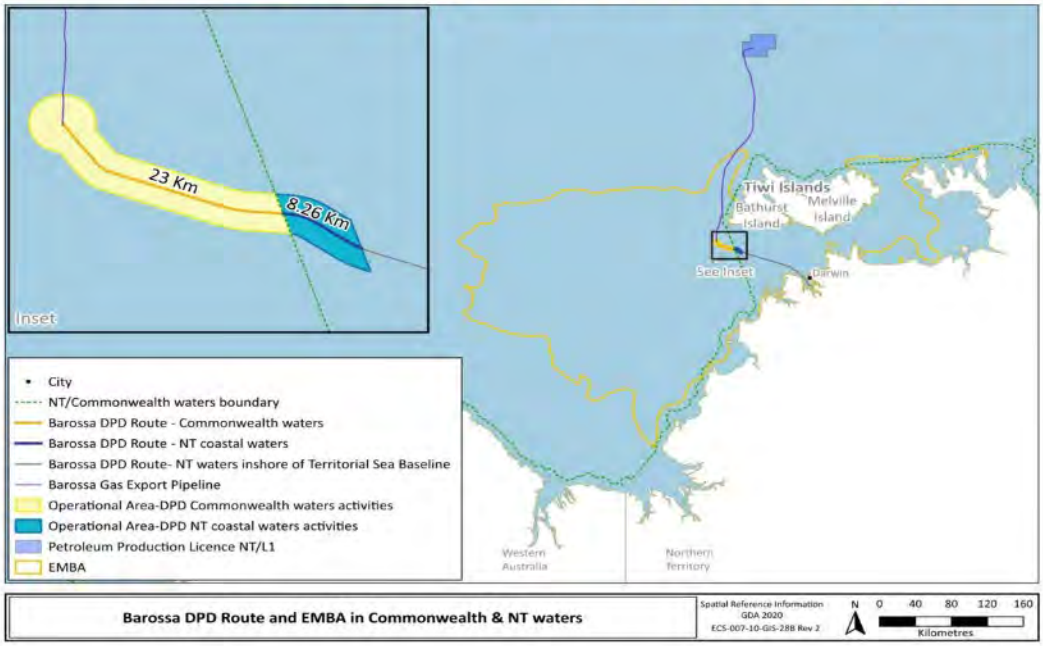
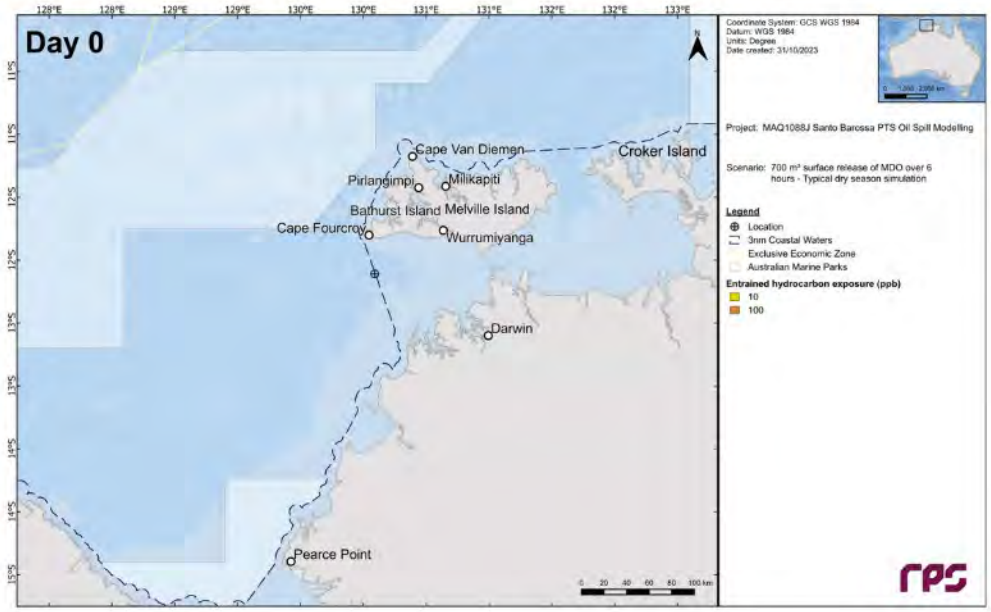


DPD Diesel Spill Animation – typical dry season simulation

Santos



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BAROSSA PRODUCTION OPERATIONS ACTIVITY OVERVIEW

Production Operations Activity Video

Production Operations Activity - Summary

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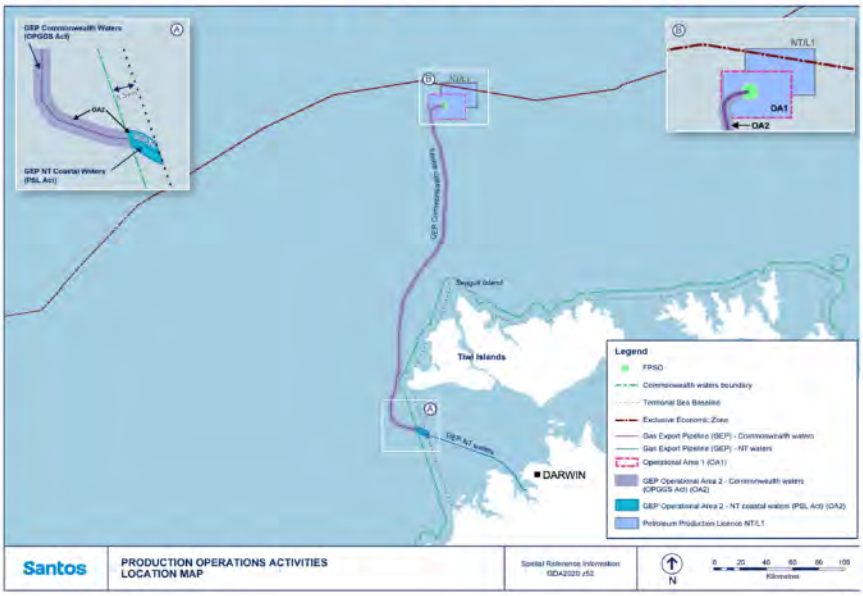
Key Activities	
Arrival FPSO	arrival & connection to mooring buoy
Hook-up & Commissioning FPSO systems & subsea equipment	Commissioning activities (testing) and prepare for start-up
Production Operations FPSO systems & subsea equipment	gas & condensate is processed on the FPSO
Offtake operations FPSO & tankers	condensate stored on the FPSO is removed 4-5 times a year by offtake tankers
Gas Export Pipeline Operations	dry gas is sent to DLNG via the GEP
Support Operations Vessels	transport food & materials
Support Operations Helicopters	transport people to/from FPSO
Support Operations-IMMR GEP & subsea equipment	planned underwater visual Inspection, Maintenance, Monitoring and Repair activities using remotely operated vehicles



Production Operations Activity - FPSO

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FPSO

- 359m long or approx. 2.5 MCG football fields
- 64 m wide ,
- Houses 140 people

Mooring Line Chains

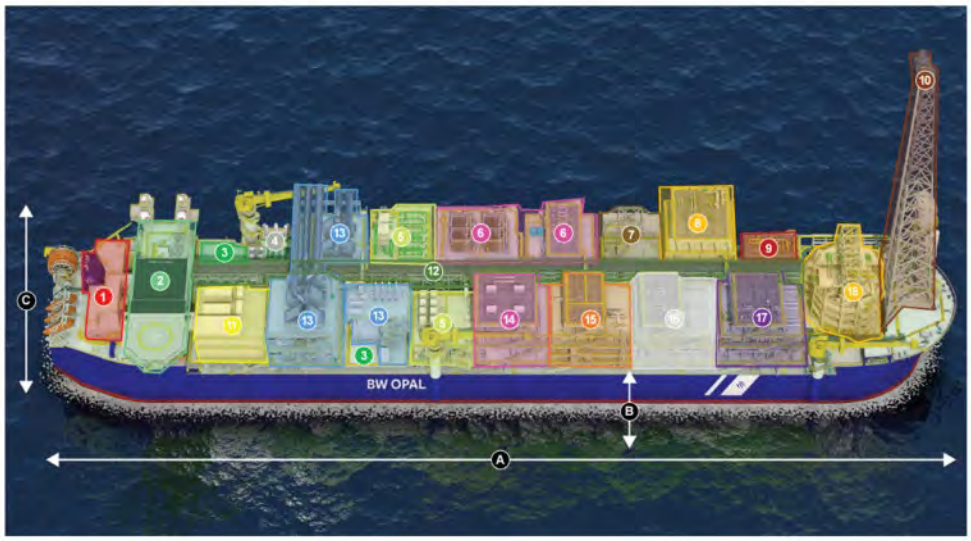
- Chains attach to FPSO mooring buoy & anchor piles
- Total of 11.3 km in length
- Weigh 5500 tonnes or approx. 2200 land cruisers

Anchor piles

- sink into seabed & attach to mooring buoy
- 19m high x 7m round
- Weigh 140 tonne each

Santos

Production Operations Activity - FPSO



1. Engine Room
2. Living Quarters
3. Laydown Areas
4. Seawater Lift Caissons
5. Utilities
6. Gas Treatment A & B
7. Condensate & Produced Water Treatment
8. Production Separation Module
9. Flare Knock Out Drum
10. Flare
11. Electrical-House
12. Central Piperack
13. Power Generation A, B & C
14. Gas Treatment C
15. Flash Gas Compressor
16. Future LP Gas Compressor
17. Export Gas Compressor
18. Turret

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BAROSSA PRODUCTION OPERATIONS PLANNED ACTIVITIES IMPACTS & RISKS

Presented by **Barossa Team**

Production Operation Activity Impacts

Santos

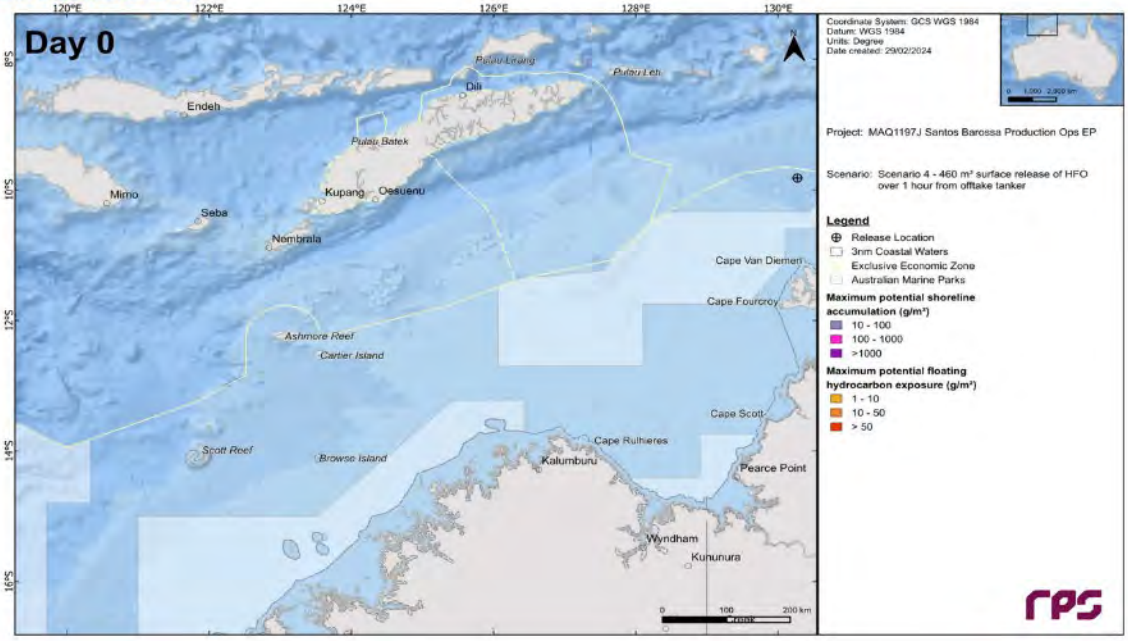
Planned Activities	Expected Impact	How we Manage (the rules we follow)
Light emissions	Behavioural impact to marine life (e.g., attraction)	We only use lights where needed for safe operations and to comply with relevant safety rules. We turn off lights when not required.
Noise emissions	Behavioural impact to marine life (e.g., avoidance)	The FPSO has been designed to reduce noise emissions. We follow procedures and look out for marine life (e.g. whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. Boats and equipment will be maintained to minimise noise
Seabed disturbance (from inspections, maintenance, monitoring and repair)	Temporary loss of habitat	We will accurately and safely place infrastructure using dynamic positioning to minimise seabed disturbance. Records of all installed equipment will be kept so it can be removed during decommissioning.
Discharges (produced water, discharges from the FPSO, subsea equipment and boats)	Impact to water quality	We will manage discharges to acceptable levels and follow the standard rules for what boats can discharge. We will select chemicals that are environmentally acceptable, and we will limit their use to only what is needed. We will use a water treatment system for produced water discharges and the water will regularly be tested before release.
Air emissions	Impact to air quality	The FPSO has been designed to reduce air emissions. We ensure engines and other equipment are looked after and low emission fuel will be used.
Greenhouse gas emissions	Insignificant contribution to national and international greenhouse gas levels from direct and indirect emissions	The FPSO has been designed to reduce greenhouse gas emissions and we will have a Greenhouse Gas Management Plan to minimise greenhouse gas emissions over the life of operations. We will comply with the Australian Government Safeguard Mechanism and also legal and regulatory requirements for emissions reporting.
Physical presence (disturbance to other boats)	Exclude other users from activity area	We will communicate to other boats where we are and what we are doing. We mark the location of equipment on charts.

Production Operations Unplanned Risks

Santos

Unplanned Events (Accidents)	Unplanned Impact	How we manage (the rules we follow)
Dropped objects	Impacts to water quality, disturbance to seabed and marine life	We follow strict procedures to stop objects dropping overboard and we pick up objects when it is safe to do so.
Disturbing marine animals	Disturbance (e.g. collisions) to marine animals	We look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. We follow rules that outline how we need to interact with marine animals.
Invasive marine life (marine pests)	Impacts to other marine life and industry if pests establish	We ensure boats have low risk for carrying marine pests before they arrive. We have plans and equipment in place on boats to prevent invasive marine species. The Federal government has strict rules we need to follow. The FPSO will have a quarantine management plan.
Chemical spill	Water quality and marine life impacts	We select chemicals that are environmentally friendly where possible and store them carefully. We have procedures for using and cleaning up chemicals.
Dry gas release	Impacts to marine life, water/air quality, other marine users and cultural features	The pipeline is designed to withstand impacts from dropped objects. We follow strict rules for lifting equipment and have emergency response procedures. The infrastructure location is marked on nautical charts. We have operating procedures and a safety case to prevent a loss of gas.
Minor hydrocarbon releases	Impacts to marine life-and water quality	We have procedures in place to manage the handling and transfer of hydrocarbons.
Larger hydrocarbon releases (marine diesel oil, marine gas oil, condensate, heavy fuel oil, well fluids)	Impacts to water quality, habitats and marine life, other marine users and cultural features	We make sure all the boats are following the rules for preventing collisions. We let other boats know where we are and what we are doing. We follow strict procedures for refueling. We will have well operations management plans setting out the systems in place to ensure well safety. We have plans (OPEP) arrangements in place for responding to spills.

Production Operations Spill Animation – typical dry season simulation



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CLOSE OF CONSULTATION

Santos

COMMUNITY UPDATE

Employment and Training

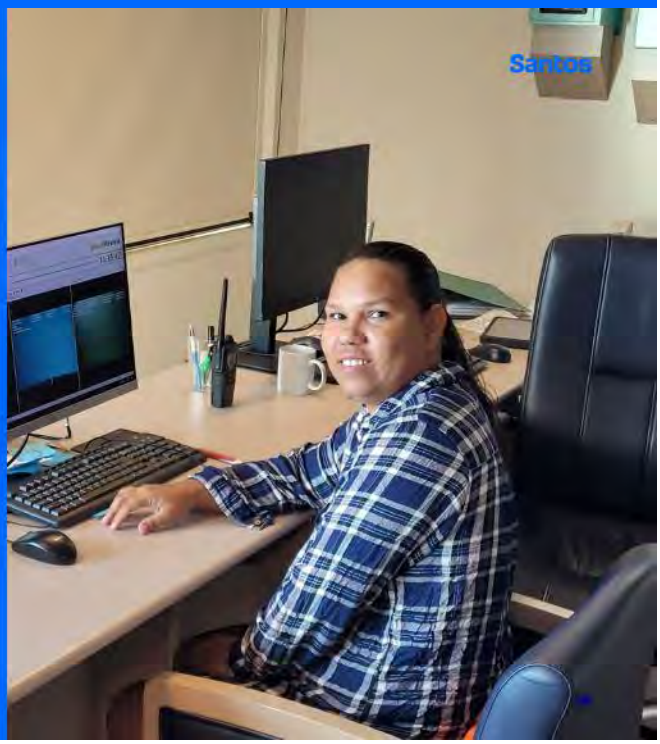
Employment Updates

Pipelay Cultural Observers & Monitors:

- 5 Tiwi People engaged as Cultural Observers & Monitors on Allseas Pipelay and Survey Vessels.
- Review ROV Footage during surveys and provide support if any finds on seabed while the Barossa pipeline is being laid.

Drilling Rig Roles:

- 7 First Nations people from Larrakia and Tiwi are employed in entry level offshore roles on the Santos contracted drill rig for Barossa
- Roles include assistant Roustabouts, Storekeepers, Utility, Electrician
- To be successful for Offshore roles, candidates must undergo a mandatory medical, complete a Helicopter emergency training course (funded by Santos), and be able to obtain a passport.



Indigenous Training Employment Programs

Santos-Kaefer (funded by Darwin LNG)

- Support Indigenous peoples by equipping participants with skills and knowledge to prepare them for long-term employment opportunities.
- Onsite training in Darwin at Darwin LNG and Kaefer workshop in Darwin.
- Training areas include scaffolding, HSE Traineeship, University Degree (HR or Mech Engineering), Accounting/ Bookkeeping Traineeship, Trade Apprenticeship

Santos Health, Safety & Environment Advisor Traineeships

- 2 x HSE Advisor Traineeship with Santos, in partnership with Programmed Skilled Workforce to obtain a Certificate IV in HSE
- Full-time12-18 month traineeship, working with the Santos Health, Safety & Environment Team
- Trainees will initially work offshore on the mobile drill rig for Barossa on a 3 weeks on/ 3 weeks off even time roster

Santos

BAROSSA ABORIGINAL FUTURE FUND

Community Benefits

Santos is committed to supporting the communities where we operate

NT Aboriginal Coastal Communities (including homelands & outstations)

The Barossa Aboriginal Future Fund (BAFF) will invest in areas that provide an enduring legacy for NT Aboriginal Coastal Communities by:

- Improving community infrastructure
- Improving services that improve health, education, housing, community resilience and economic outcomes
- Enabling communities to maintain cultural practices and carry out cultural obligations
- Enabling communities to care for their country
- Building capacity to establish pathways to skilled, well-paying, secure jobs and business development opportunities.

NT Aboriginal Coastal Communities the Barossa projects operates in includes Tiwi Islands, Darwin-Daly-Wagait, West Arnhem, East Arnhem and Victoria River District.

Santos Global Community Investments

Santos use our community investment programs to help create a positive legacy, building a better future in the areas we operate

Alaska
Alaska Native Science & Engineering Program (ANSEP) provides STEM educational opportunities for students. This summer, Santos hosted four students from ANSEP's Summer Bridge and University Success Program, providing hands-on experience and expanding their career opportunities.

Timor-Leste
St John of God Nursing Development Program helping improve public health service delivery by providing training to health professionals. During 2023, 995 health workers received training through the Program.

Papua New Guinea
Partnership with the Kutubu Kundu and Digaso Festival (KKDF) Committee in Pimaga, Kutubu, Southern Highland Province to support the sanitation facility at the festival, including water closet toilets, shower facilities and hand basins to increase hygiene and safety for 2,000 community members and partners in attendance.

Santos Foundation - Supporting local PNG priorities

Healthcare, Community Development, Family & Sexual Violence, Youth Opportunities

Helping the next generation

"We want to see the children excel in early childhood learning so they can continue to elementary schools equipped with the fundamental tools they need."

Pale Mbipe of Hela Province, PNG

Unlocking barriers to healthcare

"We undertook repairs to the water supply, renovated the maternity ward, and repaired other buildings at the hospital. We will be able to diagnose and treat people very quickly now with these new services available in Koroba."

Dr James Kintwa,
CEO Hela Provincial Health Authority

Bel isi PNG case management and community leadership

"We host events and learning sessions throughout the year aimed at raising awareness and imparting tools to address family violence."

Leon Buskens,
Santos Country Chair PNG

BAROSSA ABORIGINAL FUTURE FUND

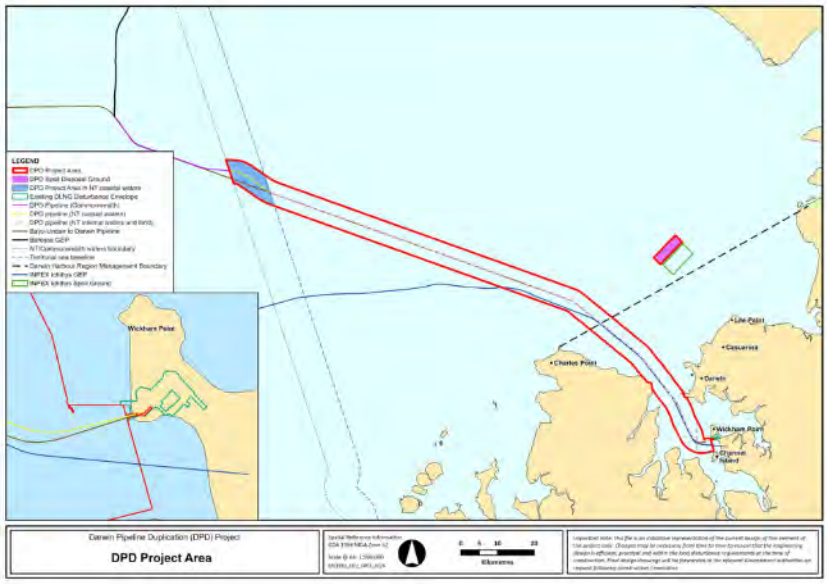
Santos wants to listen to NT Aboriginal Coastal Communities about the needs for their communities.

Santos will be engaging with NT Aboriginal Coastal Communities soon to discuss and establish legal structures with sound governance.

Santos

THANK YOU FOR ATTENDING

DPD Project area



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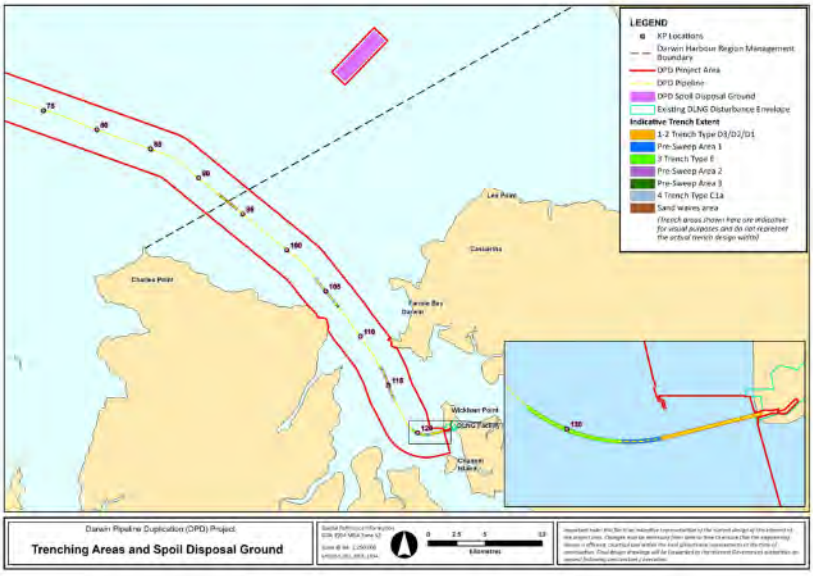
FPSO Surface Currents

Santos

DPD Trenching and Spoil Disposal Areas

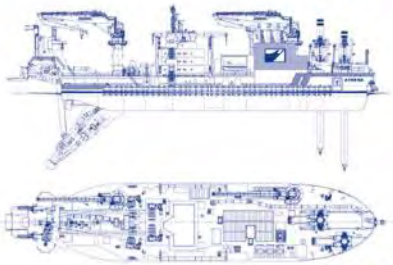


DPD Dredging Vessels

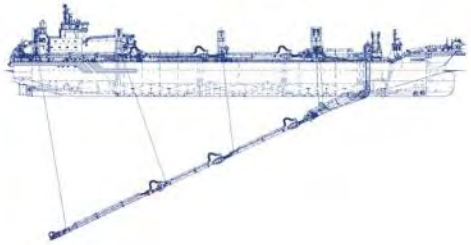
Santos

Backhoe Dredge

Trailing Suction Hopper Dredge



Cutter Suction Dredge



DPD Installation – Work Outside Darwin Harbour

Santos

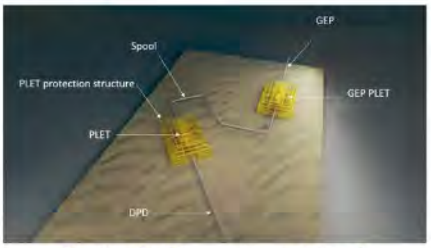
The construction activities outside of Darwin Harbour extend from the harbour limits to approximately 27km south west of the Tiwi Islands. This includes Commonwealth waters and NT Coastal waters.

Pipelay Vessel

Survey and Construction Support Vessel

Construction activities include:

- Survey
- Span correction
- Pipeline and structure installation
- Pre-commissioning
- Spool installation



Pipeline End Termination and Spool

DPD Activity Impacts

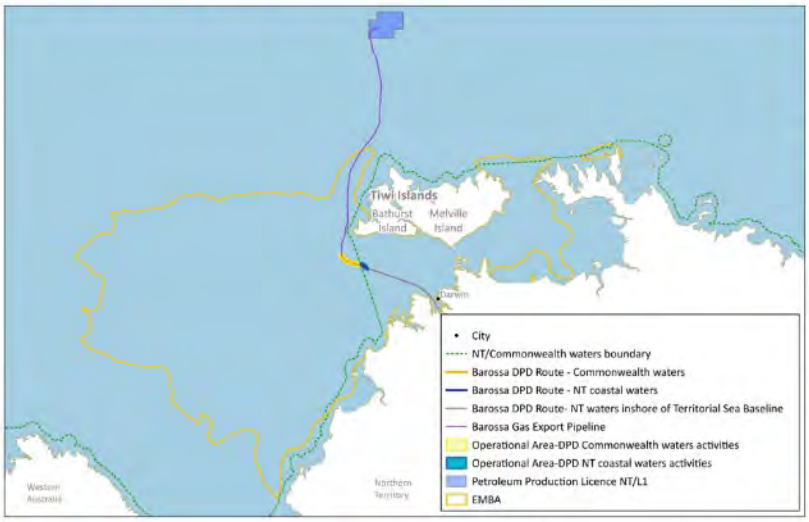
Planned Events	Expected Impact	How we Manage (the rules we follow)
Light disturbance	Behavioural impact to marine life (e.g. attraction) and disturbance to other marine users	We only use lights where needed for safe operations and to comply with relevant safety rules. We turn off lights when not required.
Underwater noise disturbance	Behavioural impact to marine life (e.g. avoidance)	We follow procedures and look out for marine life (e.g. whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. Boats and equipment will be maintained to minimise noise and operated in accordance with Federal requirements. We stop trenching is faun are too close.
Seabed disturbance (pipeline and equipment installation)	Temporary increase in turbidity, increasing sedimentation of habitat	We are putting equipment on a mainly flat sandy seabed close to an existing pipeline. We record the position of installed equipment so it can be removed at a later date. We monitor turbidity and manage trenching if too high.
Discharges (boat discharges, pipeline flooding, cleaning, gauging, testing)	Impact to water quality	We will manage discharges to acceptable levels and follow the standard rules for what boats can discharge. We will select chemicals that are environmentally acceptable, and we will limit their use to only what is needed.
Air emissions	Impact to air quality, contribution to national greenhouse gas levels	We ensure engines and other equipment are looked after and low emission fuel will be used.
Disturbance to other boats	Exclude other users from activity area	We will communicate to other boats where we are and what we are doing. We mark the location of equipment on charts.

DPD Risks

Unplanned Events (Accidents)	Unplanned Impact	How we manage (the rules we follow)
Dropped objects	Impacts to water quality, disturbance to seabed and marine life	We follow strict procedures to stop objects dropping overboard and we pick up objects when it is safe to do so.
Disturbing marine animals	Disturbance (e.g. collisions) to marine animals	We look out for marine life (e.g., whales, dolphins, turtles) and we slow down and move away from them where possible if they are too close. We follow rules that outline how we need to interact with marine animals.
Invasive marine life (marine pests)	Impacts to other marine life and industry if pests establish	We ensure boats have low risk for carrying marine pests before they arrive. We have plans and equipment in place on boats to prevent invasive marine species. The Federal government has strict rules we need to follow.
Chemical spill	Water quality and marine life impacts	We select chemicals that are friendly to the environment where possible and store them carefully. We have procedures for using and cleaning up chemicals.
Gas release (dry gas or nitrogen) - Bayu-Undan pipeline	Impacts to marine life, water/air quality, other marine users and cultural features	We follow strict rules for lifting equipment and have emergency response procedures. We have procedures in place to minimise loss of gas from Bayu-Undan pipeline.
Diesel spill	Impacts to water quality, habitats and marine life, protected areas, other marine users and cultural values/sensitivities	We make sure all the boats are following the rules for preventing collisions. We let other boats know where we are and what we are doing. We follow strict procedures for refueling. We have plans and arrangements in place for responding to spills.

DPD Environment That May Be Affected – Diesel Spill

Santos



Barossa DPD Route and EMBA in Commonwealth & NT waters

Audacia (pipelay vessel) – 225 m.

700,000 L of diesel is worst case spill

Bulk carrier – 187 m

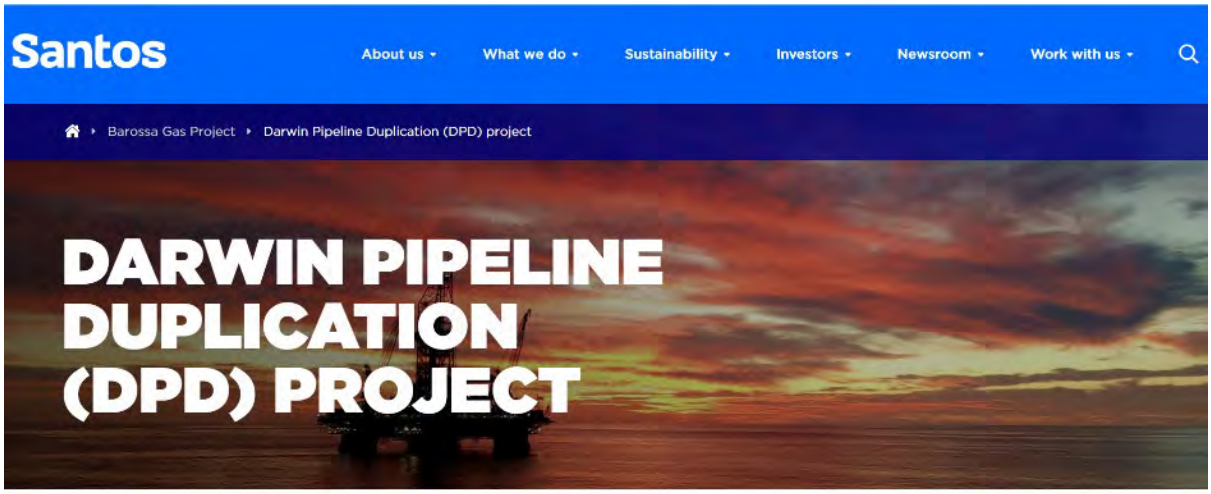
Cruise ship – 298 m

DPD Cultural Heritage Management Plan

Santos

- Santos is finalising a Cultural Heritage Management Plan (CHMP) which will help ensure First Nations cultural heritage is respected and protected during the DPD Project construction activity
- The CHMP is a requirement of Santos' NT environmental approval and will be submitted to the NT Government
- The CHMP includes the following measures:
  - Rules for the protection of sacred sites – no-go zones for vessels and compliance with AAPA certificate
  - An Unexpected Finds Protocol – to manage any unexpected finds of First Nations objects
  - Training and inductions for all workers – to provide awareness of Larrakia connection to the construction area and requirements for avoiding sacred sites
  - Larrakia Project opening/ Welcome to Country
  - Opportunities for Larrakia as monitors/observers during DPD construction activity
  - Involvement of Larrakia Rangers in environmental monitoring – water quality and marine fauna monitoring

Santos Website



Activity 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 (DLNG) facility.

Santos is currently preparing:

- an Environment Plan (EP) relating to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters where offshore petroleum activities are regulated by the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) (OPGGS Act); and
- an Offshore Construction Environmental Management Plan (CEMP) which includes the installation of approximately 8.26 km of the DPD pipeline in an area covered by the Northern Territory Petroleum (Submerged Lands Act) 1981 (NT) (PSL Act).

The activities described above are more simply referred to the 'DPD activity'.

DPD Project activities include those undertaken in Commonwealth waters, approximately 95km north-west of Darwin and approximately 27km south-west of the Tiwi Islands (Figure 1) and those undertaken in an area of NT coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline (TSB) with a width of approximately 5.5km.

The proposed pipeline will be located parallel to the existing Bayu-Undan to Darwin pipeline to minimise potential environmental and social impacts. Activities will occur within an operational area defined as approximately a 3000m radius around the PLET and a 2000m buffer either side of the DPD route. The operational area encompasses the installation of the DPD, as well as the movements of support vessels in the immediate vicinity of the pipelay vessel. Activity vessels and helicopters within the operational area are considered part of the activity under the DPD EP.

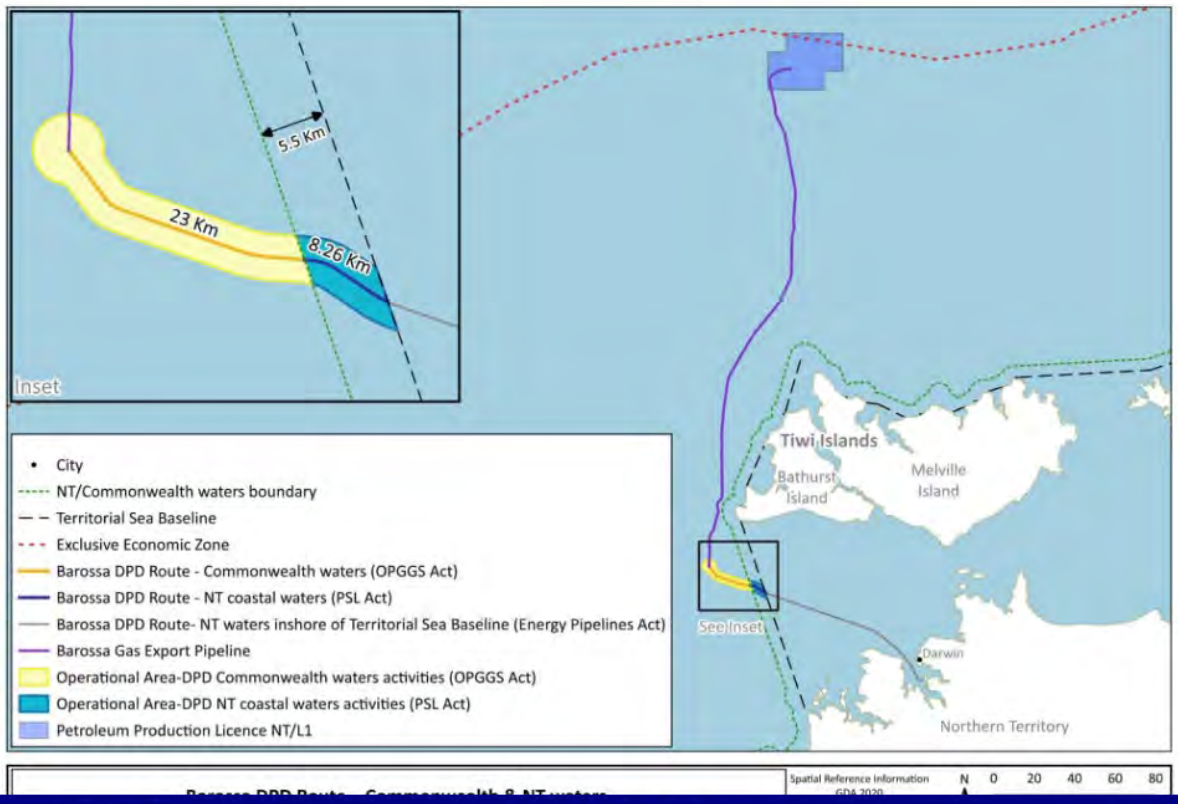


Figure 1: Location of the proposed DPD Route in Commonwealth waters and NT coastal waters

Approvals process

The Commonwealth Government's independent expert regulator for offshore oil and gas development, National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), accepted the Barossa Offshore Project Proposal (OPP) in March 2018.

The DPD Project, specifically the proposed activities in Commonwealth waters, was not included in the Barossa OPP, as the initial intent was to tie the Barossa gas export pipeline directly into the existing Bayu-Undan gas export pipeline. The current intention is to preserve the existing Bayu-Undan pipeline for potential future use to facilitate regional carbon capture and storage. Santos has referred the DPD Project (including the portion of the Project in Commonwealth waters) to the Minister under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The DPD Project was determined to be a 'controlled action' on 6 December 2022. Approval of the DPD Project under the EPBC Act will constitute the government's 'project-level' environmental approval for the Project, with installation and operation of the DPD Project in Commonwealth waters to be subject to acceptance of activity-level EPs by NOPSEMA.

The DPD Project within NT jurisdiction requires primary approval under the Environmental Protection Act 2019 (NT) (NT EP Act). Following a public comment period, the DPD Project referral under the NT EP Act was determined by the NT Environment Protection Authority (NT EPA) to require assessment by way of Supplementary Environmental Report (SER). The DPD Project SER has been submitted to the NT EPA and has undergone a public comment period. The SER is currently under assessment.

To be accepted by NOPSEMA, an EP must meet the requirements set out in the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS Environment Regulations).

For the DPD activity in NT coastal waters, a DPD Construction Environmental Management Plan (CEMP) will be submitted to the NT Department of Industry Tourism and Trade (DITT) for acceptance under the PSL Act.

In order to meet its proposed schedule for the Barossa Gas Project, Santos is aiming to submit the DPD EP to NOPSEMA and the CEMP to DITT and, subject to regulatory acceptance, to commence activities in 2024. This timeline has been developed by Santos to meet this objective, while still providing a reasonable period for meaningful consultation, having regard to Santos's regulatory obligations and to feedback from relevant persons.

Seeking information and what's next

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose **functions**, **interests** or **activities** may be affected by the activity proposed to be carried out under an EP.

For more information about 'relevant persons' please click here or scan this QR Code:

Relevant persons being consulted on EPs under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (OPGGS Environmental Regulations) should note that they:

- are entitled to be given sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests or activities;
- are entitled to be allowed a reasonable period for the consultation; and
- may request particular information provided in consultation not be published.

If you do ask this, Santos will respect that, and the information will not be published under the OPGGS Environment Regulations. Information we need to give to NOPSEMA to assess our plan will be provided in a separate report (rather than in the published EP).

Your input is important to Santos:

- so that we can understand the environmental values in the operational area and the environment that may be affected, and the environmental impacts and risks associated with the activity;
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.

If you think you may be a relevant person for the purposes of one of Santos' proposed activities in the Commonwealth or Northern Territory waters, please contact Santos on **1800 267 600** or email offshore.consultation@santos.com to seek to be included in consultations and to provide feedback on how you would like to be consulted (if a relevant person).

Privacy Notice

Santos Limited, Santos NA Barossa Pty Ltd and their related bodies corporate (collectively, we, our, us or Santos) collect personal information about you (which may include sensitive information about your Indigenous heritage or clan group) that you provide in this form and in any consultation with you. We use this information to engage with you, to receive and respond to any feedback that you provide, to include relevant information in any reports that we prepare, and for the purposes otherwise set out in our Barossa Gas Project Consultation Privacy Policy. Santos will handle your information in accordance with our Code of Conduct, our Confidentiality, IP and Privacy Procedure and Barossa Gas Project Consultation Privacy Policy. You can ask us for a copy of any of these documents by contacting us using the details set out below.

The laws that relate to consultation regarding the environment plans may require us to collect personal information about you if your feedback is to be included in any report we prepare (including so that a copy of that report can be provided to you if you request). If you do not provide your personal information, we may not be able to identify you as the person who provided particular feedback (including in any report relating to consultation) or discuss any feedback you have provided with you further.

The information you provide will be collected by or on behalf of us and may be disclosed to other companies in the Santos group, to third parties that help us run our business, or as required by law (including collection and disclosure of information to relevant government agencies and departments to which we are required to provide reports). Your feedback may also be reflected in our environment plans (subject to any non-publication requests, as described below). We may disclose your personal information to recipients that are located outside of Australia, including in Papua New Guinea and the United States of America.

Our Barossa Gas Project Consultation Privacy Policy and related documents described in this Privacy Notice provide further information about how we store and use, and how you may access and correct, your personal information, and how you can lodge a complaint regarding the handling of your personal information (including how we will respond to that complaint). If you would like to request a copy of any personal information that we hold about you or request that we correct any such information that is inaccurate or incomplete, you can contact us in the following ways:

- posting a letter addressed to us at 60 Flinders Street, Adelaide;
- telephoning us on (08) 8116 5000; or
- sending us an email at offshore.consultation@santos.com.

You may request that any information you provide in this form, or during any consultation, not be published (including as part of any environment plan or related reports). You can make this request by selecting the option in the form below. If you select this option, the information will not be published and Santos may contact you to discuss your wishes.

Relevant person nomination form

Darwin Pipeline Duplication Environment Plan

By completing this form I consent to Santos using the information provided in this form for the purpose of consultation on the Darwin Pipeline Duplication Environment Plan in accordance with the Privacy Notice on this page and the Barossa Gas Project Privacy Policy.

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Further information and links

- The Barossa Gas Project – Proposed Darwin Pipeline Duplication (DPD) Environment Plan fact sheets
  - DPD Information Booklet
  - DPD Approval Summary
  - DPD Construction Activities Overview Booklet
- DPD Preliminary Report
- DPD Project EPBC Act Referral
- Barossa Offshore Project Proposal
- Barossa Offshore Project Proposal appendices
- NOPSEMA Environment Plan content requirements
- NOPSEMA Environment Plan consultation requirements
- NOPSEMA Consultation on offshore petroleum environment plans – information for the community
- *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*

Barossa Gas Project Frequently Asked Questions shared with Tiwi people referred to in Section 4.5.4.3 of the EP

Barossa Gas Project
Frequently Asked Questions

Santos is committed to providing all Relevant Persons access to information about the Barossa Gas Project in a timely and consistent manner. The following list of Frequently Asked Questions (FAQs) has been developed based on questions provided to Santos. This document will be updated on an ongoing basis during the development and delivery of the project as new information becomes available. The answers provided in this document are intended to provide clear, summary responses to the questions. Should you require more detailed information, further explanation or have any other questions, please ask one of the Santos team, contact us via telephone on 1800 267 600 or via email at offshore.consultation@santos.com.

Question	Answer
Spill (oil, gas, condensate)	
We've already seen the impacts of the Montara oil spill. Is there a chance of an oil spill for this project?	Santos was not involved in the Montara oil spill in August 2009. It resulted from a series of operator and regulatory failures which have now been comprehensively addressed through improved practices across the industry and improved regulatory regimes, now administered by NOPSEMA. More detail as to the initiatives undertaken by governments, regulators and industry following the Montara oil spill are available in the Australian Government Report on the implementation of the recommendations from the Montara Commission of Inquiry (September 2017): https://www.industry.gov.au/sites/default/files/2022-09/australian-government-report-on_the_implementation_of_the_recommendations_from_the_montara-commission-of-inquiry.pdf. Barossa is very different from Montara. Barossa is a gas and condensate field rather than oil. The well design and type of drilling rig for the Barossa field are different to those used at the Montara field. For example, the Barossa wells will not be suspended for the rig to depart the field and return at a later date (as occurred at Montara). Further, the aspects of well design and operations at

	Montara which were significant contributors to the Montara spill are not permitted under the current regulatory regime and Santos' drilling standards and procedures. The likelihood of a gas and condensate spill event during Barossa drilling is remote. The drilling at Barossa is subject to strict regulation, including in respect of the design of the wells and safety shutdown systems, regular inspection and maintenance schedules and operation by well-trained and highly competent staff. Well blowout events during development drilling, that could result in a spill, have been reported at a frequency of approximately one event for every 29,000 wells drilled. The Australian Government, along with PTTEP Australasia (operator of the Montara oil field), developed a long-term environmental monitoring program to understand the longer-term impacts of the Montara oil spill on the marine environment. There were seven scientific monitoring studies under the environmental monitoring program. Santos understands the key findings include: ○ no confirmed reports of impacts to marine wildlife in the vicinity of the oil spill ○ presence of hydrocarbons in submerged marine banks in the region of the spill but the levels identified were very low and significantly lower than would be expected to cause biological effects ○ no evidence of hydrocarbon residue on beaches, coral reefs or seagrass beds at any of the study sites ○ no evidence of the Montara spill having long-term impacts on seas snakes or marine turtles in the region. More detail as to the scientific monitoring following the Montara oil spill can be found at: https://www.dcceew.gov.au/environment/marine/marine-pollution/montara-oil-spill/scientific-monitoring-studies.
How do you plan to clean up a spill?	Barossa is a gas and condensate field.

	Condensate is a very low viscosity (thin) and low density (light weight) liquid that evaporates quickly, particularly considering both the atmospheric and sea surface temperatures in the Arafura Sea. As such, if spilt on the sea surface, condensate would be expected to rapidly spread out, with a large proportion evaporating. Condensate spills are usually left to evaporate and dissipate at sea rather than using containment or dispersants. The International Tanker Owners Pollution Federation (ITOPF), which advises industry and governments worldwide about marine hydrocarbon spill cleanup, states: *"Condensates typically break up naturally in wind and waves with the majority evaporating within a matter of days. Traditional containment and recovery operations are not typically recommended. Any attempt to concentrate the condensate would reduce the rate of evaporation and, if the concentration of vapour becomes high, could cause the oil to ignite."* ITOPF goes on to say: *"Dispersants are ineffective on condensate spills as they will 'herd' the sheen rather than promote the formation of droplets in the water column. Spills of condensate in the marine environment are best left to evaporate and dissipate at sea."* In the event of a spill, up to 57% of the condensate is expected to evaporate over the first few hours/days and up to 79% after a few days, depending on weather conditions, sea state and time of year. Santos is required to prepare an Oil Pollution Emergency Plan (**OPEP**) for each drilling activity, which forms part of the Environment Plan (**EP**) and is assessed by the offshore regulator (**NOPSEMA**). The OPEP sets out the process to manage a spill. The OPEP identifies and prioritises spill response strategies for all potential spill events and describes how Santos prepares to respond in the remote event of a spill. The response strategies in the OPEP are based on spill modelling, which is used to forecast the potential extent of a range of spill scenarios for each drilling activity. The first priority under the OPEP when responding to a spill event is to employ source control strategies, which include shutting in the well at the Blow Out Preventers to prevent loss of gas and condensate from the well into the environment.

	For condensate that has already been released to the environment the recommended primary response strategy under the OPEP is to monitor and evaluate the situation. Numerous resources are used to monitor the behaviour and direction of any released condensate, such as real-time, updated spill trajectory modelling, tracking buoys, vessel surveillance, aerial surveillance, satellite imagery and water quality monitoring to determine the effectiveness of the source control methods which may be required. Because of the low viscosity (thin nature) of condensate, natural weathering processes are most effective and have the highest net environmental benefit when compared to other recovery strategies which require human intervention. It is unlikely that condensate from a spill at Barossa associated with drilling and completions activity would reach any shoreline. The closest distance from the edge of the predicted movement of a spill to the edge of the Tiwi Islands (Seagull Island) is 54km.
Can you provide insurance to cover all costs to clean up a spill and rehabilitate the sea and coastline affected? And compensate us for our loss of food?	Santos and its Barossa joint venture partners are required to demonstrate a minimum level of financial assurance to be able to cover costs when responding to a spill event. The offshore regulator, NOPSEMA, will not accept the Drilling and Completions Environment Plan without Santos first demonstrating a minimum level of financial assurance for a spill response. Santos relies on a combination of its own financial resources and insurance to meet its financial assurance requirements, including third party liability insurance for its activities. For each OPEP there is a comprehensive scientific monitoring program to measure impacts to the physical/biological environment and socio-economic receptors. The results of monitoring inform the extent of impacts. Whether any claim or any compensation may be available will depend on the specific circumstances. Any claim would be determined based on the evidence (as with any claim).
Who will receive the insurance and the compensation?	Whether any claim or any compensation may be available will depend on the specific circumstances. Any claim would be determined based on the evidence (as with any claim).

Will you provide training to local communities on the coastline to be able to respond immediately? And will you provide us with the equipment needed to clean up the spill. Who decides where this equipment will be located and stored? We understand that in your Environment Plan you've said that the equipment will be stored in Darwin – how long will it take for you to get this equipment to the spill site which is 260km from Darwin?	Santos has access to a wide network of spill response equipment across Australia and internationally to support its primary and secondary response strategies, which are outlined in the Barossa OPEP, to monitor and evaluate any spill. Depending on the spill response resources required, Santos would be able to mobilise these resources rapidly, relying on its established logistics networks. Due to natural weathering, it is unlikely that condensate from a spill at Barossa would reach any shoreline. Santos is open to working constructively and cooperatively with Tiwi Island communities and community organisations about opportunities for Tiwi Islanders to support hydrocarbon spill response activities, including environmental monitoring in the remote event of a spill.
How will you tell us when something goes wrong? Where does it say in the Environment Plan how many days after an oil spill that you are required to tell us that the spill has happened and who will you notify?	Santos is required to notify NOPSEMA, the offshore regulator, and a number of other government agencies, as soon as practicable if a spill was to occur. Santos is aware that Tiwi Island communities will want to know about any spill event. Santos therefore proposes to include Tiwi Island community organisations in its first round of notifications if a spill was to occur.
What is condensate?	Condensate is a very low viscosity (thin) and low density (light weight) liquid, which is referred to as a light "hydrocarbon". It is straw-coloured, flammable and is similar to cigarette lighter fluid. Condensate evaporates quickly when it is spilled into the sea, especially in environments such as those surrounding the Barossa field.
How does a spill of condensate impact marine life?	Condensate has the potential to impact marine life in the event of an unplanned release of condensate from a well during well construction. Many factors affect the extent of condensate impact on marine life, including the spill location, volume, duration, type, trajectory, season and atmospheric and oceanic conditions. Depending on how much condensate is released and the extent of exposure, condensate can cause stress to marine life, such as seabirds and marine mammals, including irritation of eyes/mouth and illness. In extreme situations with large volumes of condensate spill in an enclosed area, the impact could be fatal.

	Two areas are relevant to marine life impact associated with the drilling and completions activity at Barossa: • The "MEVA" is an area surrounding the drilling site of the Barossa project which is used to inform environmental assessment, identify potential environmental consequences and develop spill response plans. • The "EMBA" is a broader area surrounding the MEVA which represents the broadest area which could be affected by an unplanned 'worst case' spill event during drilling without any spill response actions. The EMBA is larger than the MEVA. A condensate release could impact on benthic organisms, fish, coral and invertebrates. Other marine life such as turtles, whales (including the pygmy blue whale) and seabirds which infrequently transit through the MEVA or EMBA may also be adversely impacted by a spill of condensate but these species are less likely to be present in the MEVA. A spill is not anticipated to impact key areas for marine turtle breeding and nesting. The impacts of one of Australia's largest oil spills have been assessed over a number of years. The results of scientific monitoring after the Montara oil spill can be found at: https://www.dcceew.gov.au/environment/marine/marine-pollution/montara-oil-spill/scientific-monitoring-studies. Environmental monitoring following the Montara oil spill has found no significant long-lasting impacts.
What happens if there is a gas leak?	If a gas leak from a well was to occur during well construction, any escaped gas would rapidly float to the sea and then disperse into the atmosphere. Operations would be suspended to identify and control the source of the leak. The greatest risk from a gas leak is the safety of the workers on the drilling rig, nearby support vessels and their crew, due to the potential ignition of gas resulting in fire or explosion. Santos has detailed emergency response and evacuation procedures designed to protect the safety of all in such a situation, including trained firefighting teams.
Marine life	
How will you stop turtles getting killed by your ship's propellers? Our turtles are already suffering	Santos must adhere to practices under relevant legislation and regulations to avoid collisions with turtles and other marine fauna. This includes reducing vessel speeds and maintaining minimum

from climate change – can you guarantee that the Barossa project won't make this worse? What will you do to make sure they survive this?	distances when marine fauna is sighted. Interactions between vessels associated with the drilling and completions activity for the Barossa project and marine fauna are considered under the current Drilling and Completions EP. Any unplanned interactions with marine fauna in the drilling operational area are expected to be limited to a small number of individual animals transiting through the area. The operational area does not intersect any biologically important area or habitat critical to the survival of any marine fauna species. The risk to marine turtles in the drilling operational area is very low. All Santos contracted vessels are required to maintain a marine fauna sighting record and record any interactions with marine fauna.
We don't want your choppers flying over the Tiwi Islands – we don't want to be able to hear the helicopters. We also don't want you to fly near Seagull Island so that our seagulls don't get killed.	Santos will not fly any helicopters directly over the Tiwi Islands (including Seagull Island), unless there is an emergency. The only time a helicopter may need to fly over the Tiwi Islands is in the unlikely event of an emergency where there is a requirement for the flight time to be completed as quickly as possible (for example if someone falls into the water and Santos needs to conduct a search and rescue operation). Helicopters may also need to use one of the airports on the Tiwi Islands for an emergency landing if something happens during a flight. Like all aircraft, the helicopter will need to comply with all relevant aviation standards and regulations and will need to go to the nearest place that they can land if there is a serious issue during flight.
Consultation	
We want you to keep us updated on the whole process. We want you to come in person and host	Santos is committed to developing a strong, beneficial relationship with Tiwi Islands People and your feedback is important to achieving this.

clan group meetings to share these updates. What is your plan for ongoing consultation with us?	Your input during consultation is important to assist Santos to understand and evaluate environmental impacts and risks and to develop control measures to reduce these impacts and risks to as low as reasonably practicable and acceptable levels. At our sessions in February 2023, Tiwi Island communities told us that they would like to consult on environmental plans through clan group consultation sessions and for Santos to use videos and other visual aids to help explain the Barossa project. We have taken on board that feedback. We will keep you informed through, for example: • clan or community meetings (to be scheduled considering feedback as to appropriate regularity/frequency) • project updates/newsletters • notices or updates posted on Tiwi community notice boards • updates or articles in the Tiwi Newsletter • social media posts • the Santos website and "Barossa Hub" (https://www.santos.com/barossa/) We will provide opportunities for feedback, including through: • talking to our team when they are on the Islands • talking to us at any scheduled Santos community meetings • telephoning us on 1800 267 600 • emailing us at offshore.consultation@santos.com • using the relevant person nomination/feedback form and portal at https://www.santos.com/barossa/ • the Tiwi Land Council If you have any other suggestions, please let us know.
When this consultation happens, we want to have Santos, Environment Centre NT, Tiwi Land Council senior management (CEO and Chairperson), Tiwi Islands Regional Council members and we want to	The Tiwi Islands consultation sessions have been well attended with Tiwi Islanders, senior representatives from Santos, Tiwi Land Council, Tiwi Regional Council and ECNT present.

be able to engage any relevant expert advisors based on the information provided to us before the meeting happens.	Anyone is welcome to attend the consultation sessions (though in the case of clan meetings, with clan Trustee consent). Experts such as internal expert Benjamin Fischer (Drilling Superintendent), and external expert Dr Kellie Pendoley (marine turtle expert), have attended consultation sessions. Santos will continue to bring both internal and external experts to the consultation sessions to assist with explaining the detail of, and answering questions about, our proposed activities.
If it's about turtles, we want a local expert such as professors or scientists from CDU and As Turtle. We will not accept desktop reviews from interstate.	Santos has engaged a world-renowned marine turtle expert Dr Kellie Pendoley, of Pendoley Environmental, to provide expert advice on marine turtle impacts and management. Dr Pendoley has more than 30 years' experience in marine conservation biology and artificial light assessment. Dr Pendoley has visited the Tiwi Islands on two occasions in the context of consultation and is assisting Santos with additional data and information collection and assessment to develop the understanding of marine turtle behaviours around the Tiwi Islands. Dr Pendoley is familiar with the turtle habitats in the region as a result of contributions to Barossa environmental impact assessment studies and from her extensive experience studying marine turtles around Australia and other locations globally. Dr Pendoley expects to complete her assessment in the coming months.
Will you provide an interpreter?	Santos has engaged a qualified Level 4 interpreter referred by, and engaged through, the NT Government's Aboriginal Interpreter Service (**AIS**) to attend consultation sessions (including the upcoming April 2023 sessions). Interpreters qualified through AIS are trained to interpret accurately and be impartial. We have been advised by the AIS that Tiwi culture is focused on oral storytelling and as such there is no agreed written language. The AIS has recommended that Santos provide audio translation of materials where appropriate and Santos is taking the necessary steps to do so. Santos welcomes feedback from the local community as to the best means of communicating in a productive manner throughout the consultations.

Has Santos been involved in consultation with any non-English speaking communities?	Yes. Santos has positive relationships with non-English speaking communities in the areas in which it operates throughout Australia, Papua New Guinea, Timor-Leste and North America. Santos has partnerships with a range of local, non-English speaking communities, including providing local jobs and business opportunities. Santos wants to build strong, positive and productive relationships with the Traditional Owners and communities of the Tiwi Islands. We're here to learn more and seek input and feedback on cultural values in the context of the Barossa project.
Did Santos prepare the Offshore Project Proposal?	The Offshore Project Proposal (**OPP**) for the Barossa Development was prepared by the ConocoPhillips Australia-West Business Unit that Santos now owns. NOPSEMA, the offshore regulator, accepted the Barossa Development OPP in 2018. When Santos acquired ConocoPhillips' Australia-West Business Unit in 2020, all associated licences, permits and approvals were included in the acquisition (including the Barossa Development OPP) and became the responsibility of Santos following the acquisition.
Drilling	
What happens to the wells if there is an earthquake, tsunami or other natural disasters?	The wells are all designed and drilled so that they meet government regulations and international standards for well design and operations. Historical evidence shows that wells do not leak because of earthquakes (both in the area where the Barossa wells are planned, which is not near any major faults, and around the world). Since 1969, approximately 880 wells have been drilled in the area to the west of the Tiwi Islands and none of these have experienced issues related to earthquakes or tremors. The closest long-term producing oil and gas wells are located at the Bayu-Undan Field, where 29 wells have been in production at different times since 2004 and none have been affected by earthquakes. The Bayu-Undan field is approximately 400km from the Barossa field.

	Tsunamis do not affect drilling rigs or vessels located in deeper water such as the Barossa field, where the water depth is over 200m. Waves created by tsunamis cause damage when the wave reaches land and the shallower water causes a large wave to form above the normal level of the ocean.
What lubricates the drill?	A drilling fluid (sometimes referred to as "drilling mud") is circulated in the borehole and provides cooling and lubrication to the drill bit and carries the rock cuttings/chips out of the well.
What is in the drilling fluid?	A water-based drilling fluid (or drilling mud) is planned to be used to drill the wells for the Barossa project. This mud is mainly a mixture of fresh water and salt that is then combined with other additives that make the mud thicker, heavier or control how the mud affects the natural clays in the rocks that are drilled. The additives are not harmful to humans nor sea life in small quantities and in diluted form (as they are used in the drilling mud). Santos relies on a recognised industry chemical classification system run by a specialist agency, the UK Government Department of the Environment Food and Rural Affairs, and uses additives in the mud which have the lowest environmental impact rating. Sometimes water-based drilling fluid or drilling mud is insufficient for drilling activities in deep water. In that case, Santos will use a Non-Aqueous Fluid (**NAF**). NAF uses a base fluid that is a synthetic oil. The additives used in the NAF are, on the whole, the same as those used in the water-based mud. Where NAF is required to be used, equipment is used on the rig to remove the NAF from the drilled-up pieces of rock that come out of the well, so that the NAF can be reused. This equipment is similar to a clothes dryer. The drilled-up pieces of rock are returned to the sea only when the amount of NAF is below a certain amount. The process is the same as that for other wells that use NAF offshore in Australia and in many parts of the world.
When you are drilling, what do you hit first (before you reach the gas)?	The drill bit goes through a series of limestone and claystone rocks before reaching the sandstone reservoir that contains the gas. The limestone and claystone rocks above the gas reservoir are impermeable and have trapped the gas and condensate in the Barossa reservoir for tens of millions of years.

	The steel pipe (casing) is cemented into place before drilling into the gas reservoir contained within the sandstone formation. The steel pipe is cemented into place like this to seal off the shallower rock formations from the gas reservoir. None of the eight exploration wells drilled so far in the Barossa field have found any oil reservoirs and reviews conducted by our geologists of the area indicate that no oil exists in the Barossa field.
Why haven't you spoken about climate change as a risk (of the drilling and completions environment plan)?	Santos is very conscious of limiting the impact of its operations on the environment. Santos will follow industry practices and procedures to minimise greenhouse gas emissions from fuel combustion and flaring during drilling operations. The current Drilling and Completions Environment Plan considers the impact and risk of greenhouse gases and atmospheric emissions from drilling and completion operations. Likewise, emissions from production operations will be further considered and assessed in the Barossa Production and Operations Environment Plan.
How long will the drilling consultation process take? When will you start drilling and will you advise us before you start?	The regulations require that Santos provide a reasonable period for relevant persons to consider information provided by Santos about the proposed drilling and completions activity, environmental impacts and risks and control measures before commencing such activity. As advised at the March 2023 clan group consultation meetings, Santos is holding another series of meetings in late April and early May 2023 to invite input and feedback and also to provide feedback on questions and requests for information received so far. There will be another series of meetings later in May 2023 to explain how the feedback from consultation is proposed to be addressed in the revised Drilling and Completions EP to be submitted to NOPSEMA, the offshore regulator, for assessment. Once acceptance of the revised Drilling and Completions EP by NOPSEMA has occurred, this will be communicated. Following acceptance by NOPSEMA, Santos anticipates commencing drilling and this will be communicated in advance.

What happened with the exploration drilling?	Eight wells have already been drilled in the Barossa field as part of the initial exploration and appraisal of the field. The first well was drilled in 1973, followed by another in 1998, another in 2006, three more in 2014 and 2015 and then the two final wells in 2017. The wells were evaluated and safely decommissioned as planned. The exploration work confirmed that a large gas reserve exists in the area. After the exploration wells were drilled and safely decommissioned, equipment at the seabed was removed. The decommissioning process for most wells involved plugging the wells with cement, cutting the casing approximately 2 meters below the seafloor and removing all equipment, before inspecting the wellsite and surrounding seabed with a remotely operated vehicle (a small remote controlled submarine). In 1973, oilfield practices were somewhat different, but the well was still safely and permanently decommissioned.
Will you keep drilling more wells if you can't find gas in the wells you have planned?	Santos has a high degree of confidence that the wells planned for the Barossa project will successfully encounter gas. This is based on the information we have gained over a long period of time—since 1973—from different exploration processes, such as seismic acquisition and the exploration wells. There is provision for eight wells in the current Drilling and Completions EP for the Barossa project, but only six are planned to be drilled (with two additional wells being provisioned in case they are necessary).
Will the drilling impact marine life?	Environmental impacts and risks from all planned and unplanned events are assessed in the current Drilling and Completions EP and control measures will be implemented to reduce impacts and risks to as low as reasonably practicable and acceptable levels. We are consulting on these impacts and risks and proposed controls. While there is potential for impacts to marine life from drilling, impacts from planned events are localised and risks from unplanned events such as a condensate spill are very low.

	With consideration of proposed control measures to mitigate impacts to marine life, the impacts are considered to be reduced to as low as reasonably practicable and an acceptable level.
How far down do you drill?	The wells will be drilled to about 4000m below the surface of the sea.
What category was the storm in the animation? (The animation showed what would happen to the FPSO in a storm)	In the area around the Barossa field, most of the storms are tropical lows or developing storms, with most of them passing to the south of the Barossa field. Fully developed storms (Australian Category 4 and 5) are not normally experienced at the location of the Floating Production Storage and Offloading (**FPSO**) facility. The FPSO is designed to survive a 10,000-year storm (involving the equivalent of wind speeds attributable to a Category 4 cyclone).
How many wells are you drilling?	Six development wells are planned with contingency for two additional wells, if needed. No more than eight wells can be drilled under the current Drilling and Completions EP.
What is a Christmas Tree?	A "Christmas Tree" is the slang name for the arrangement of metal pipes and valves that sit on top of the well to control the flow of gas and condensate out of the well and to allow safe access to the well for maintenance. Its proper name is a "Subsea Vertical Tree" and it is a piece of equipment installed on top of the well with valves and pressure and temperature gauges that is used to monitor and control the production of gas and condensate from that well.
How many wells has Santos drilled, both locally and internationally?	Founded in 1954, the South Australia Northern Territory Oil Search (**Santos**) has been developing resources first across Australia, then the Asia Pacific and is now a global energy company. Since 1954, Santos has drilled and still operates more than 6,000 wells onshore and offshore in Australia and additional wells internationally.
Will the drilling be like Deepwater Horizon?	The drilling activity for the Barossa project is different to the drilling at Deepwater Horizon. The well design for the Barossa wells is different from the wells of the Deepwater Horizon which experienced a well blowout. For example, unlike the Deepwater Horizon well, at Barossa the drilling

	stops before the well is drilled into the gas zone, casing is then installed and cemented into place, then the next smaller hole is drilled into the gas zone. This enables effective barriers to prevent the flow of gas to surface. Further, Macondo, the well that blew out on the Deepwater Horizon, was an over-pressured oil exploration well, not normally-pressured gas and condensate like Barossa. The reservoir pressure at Macondo is approximately three times the reservoir pressure in Barossa and these higher pressure wells have a higher likelihood of well integrity issues. In the event of a loss of well control, the fluids expelled from Barossa would be gas and condensate, not crude oil. These substances have very different impacts and spill response. Santos undertakes drilling activity in a strict regulatory environment. There are numerous control measures in place to control the flow of extracted substances including well design, safety shutdown systems, regular inspection and maintenance and trained and competent personnel.
Pipeline	
How is the Gas Export Pipeline laid?	The Gas Export Pipeline (**GEP**) is approximately 66cm in diameter and will be laid on top of the seabed, using a special vessel that lays the pipe. Onboard the pipelay vessel, single lengths (approximately 12-15m long) of steel pipe (joints) are welded, inspected and coated. As the pipelay vessel moves forward, the pipe gradually curves downward through the water until it reaches the touchdown point on the seabed. The vessel moves slowly, covering approximately 3km per day. There is no trenching or dredging required for the GEP installation. The pipeline route was carefully selected to minimise environmental impacts and risks. Independent experts are carrying out further assessment work to identify any cultural heritage places along the pipeline route.

How do you know if the pipeline is damaged and will you fix it if it is?	To keep the pipeline operating safely, Santos intends to carry out regular remote and on-site inspections and maintenance. Specialist equipment will monitor the pipeline's condition and integrity and provides advanced warning of potential damage. In the unlikely event of damage to the pipeline, Santos would immediately shut-in the wells to prevent any further gas from entering the pipeline and the pipeline would be depressurised. The nature of the damage would then be assessed and any necessary repairs completed. The pipeline would be restarted following confirmation of a successful repair and once any associated regulatory approvals to restart were secured.
What holds the pipeline down?	The pipeline will be made from carbon steel with an external anti-corrosion coating and concrete covering which means its own weight will hold it down on the seabed, where needed.
What is the pipeline for?	Santos is proposing to extract natural gas from the offshore Barossa field. The gas is intended to be transported via a gas export pipeline to the existing Santos Darwin Liquified Natural Gas (**DLNG**) facility in Darwin, where it will be liquefied and shipped to customers.
Is this pipeline the same as the Bayu-Undan pipeline?	The Bayu-Undan pipeline runs for approximately 502km from the Bayu-Undan gas fields in the Timor Sea to the DLNG plant. At its closest point, the Bayu-Undan pipeline is approximately 20km away from Bathurst Island. The Bayu-Undan pipeline is the same size as the proposed gas export pipeline for the Barossa project, with a diameter of approximately 66cm.
Will the pipeline impact the turtles and dugongs?	The pipeline is not likely to significantly impact turtles and dugongs. Interactions between vessels associated with the Barossa GEP installation activity and marine fauna are considered under the Barossa GEP Installation Environment Plan. The Barossa pipeline installation vessels will be subject to restrictions within designated 'caution zones'. A caution zone is defined as 150m distance from turtles. When operating vessels within a caution zone, vessels are restricted to a vessel speed of less than 6 knots, must have a lookout on the vessel for turtles and must maintain a distance of at least 50m from any turtles. Reduced vessel

	speeds allow marine life such as turtles to dive and move away from an area where there is vessel activity. All Santos contracted vessels are required to maintain a marine fauna sighting record and record any interactions with marine fauna.
How long will the pipeline installation vessel be located in the vicinity of turtle nesting beaches?	The pipeline installation vessels may be visible from the Tiwi Islands for about one month during pipelay activities. The closest the vessels will be to the Tiwi Islands is approximately 7km (West of Cape Fourcroy). Santos has completed light modelling and impact assessments to better understand the risks to nesting turtles associated with lighting. While light emissions are expected to be visible at turtle nesting beaches, it is unlikely to affect the behaviour of Olive Ridley and Flatback hatchling turtles on the beach.
Have you done checks for underground volcanoes?	As part of our environmental assessment of the pipeline, Santos carried out marine surveys along the entire pipeline route. No underground or subsea volcanoes were detected. Santos has completed a review of records of seismic activity and mapping of geologic fault lines in the region so that the proposed infrastructure locations are away from high-risk areas. The pipeline route was carefully selected to minimise environmental impacts and risks.
How safe are the pipes?	The pipeline to be used for Barossa is designed to international and Australian standards and subject to third party validation. This is a requirement of the Australian Safety Case regulatory regime. It is widely recognised and acknowledged that the regulatory regime that operates in Australia is among the strictest in the world. By designing the pipeline to the required design standard for subsea pipelines the pipeline has a very low probability of failing. For example, death by car crash is approximately 10,000 times more likely an event to occur than a pipeline failing.

Cultural heritage assessment	
How are you protecting our intellectual property rights as part of the cultural heritage assessment process for the Gas Export Pipeline?	Santos has engaged independent experts to undertake an assessment to identify any underwater cultural heritage places along the Barossa pipeline route, also referred to as the Gas Export Pipeline or GEP route, to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the GEP Installation Environment Plan. Santos has engaged Dr Brendan Corrigan as an independent anthropologist. Dr Corrigan is leading a team of other independent experts and obtaining information from Tiwi Islanders about any spiritual and cultural connections to any underwater cultural heritage places along the Barossa pipeline, or GEP, route. Santos is confident that, with their expertise, Dr Corrigan and his team will handle all confidential and sensitive information appropriately.
What process are you following for the cultural heritage assessment for the Gas Export Pipeline?	Santos has engaged independent experts to undertake an assessment to identify any underwater cultural heritage places along the Barossa pipeline route, also referred to as the Gas Export Pipeline or GEP route, to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the GEP Installation Environment Plan. Dr Brendan Corrigan is the lead independent expert. Dr Corrigan has over 25 years of experience as an anthropologist and has worked on projects identifying and documenting culturally significant places across Australia, including the Northern Territory, Western Queensland, Cape York, Torres Strait and Kimberley regions. Dr Corrigan has an experienced team of independent experts assisting him. As independent experts, they will seek inputs from people who have a spiritual and cultural connection to any underwater cultural heritage place along the Barossa pipeline route which may be affected by the Barossa pipeline (or GEP) installation activities. Santos is confident that the experts will take care that any spiritual and cultural information is collected in a culturally appropriate, respectful and sensitive way. If any information is identified as

	being confidential, the experts will respect the wishes of the people providing it and keep it confidential. The experts also want to know if there is anyone else in your community who they should be speaking with about cultural and spiritual connections with underwater cultural heritage places along the Barossa pipeline route (or GEP).
We would like you to engage with us before you start laying the pipeline, to map our sacred underwater cultural heritage sites with Traditional Owners so that the impacts can be avoided, especially where you say you want to build the pipeline.	We welcome engagement with you. The pipeline installation has not yet started. We are first causing an assessment to be undertaken to identify any underwater cultural heritage places along the Barossa pipeline route, also referred to as the Gas Export Pipeline or GEP, to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the GEP Installation Environment Plan. This is being conducted by independent, appropriately qualified experts. If the process identifies any underwater cultural heritage places along the route that may be affected by future pipeline installation activities, Santos will consider this and will update the Environment Plan as appropriate. That process would involve evaluating impacts and risks to identified underwater cultural heritage places and, if appropriate, updating proposed control measures to reduce any impacts and risks to as low as reasonably practicable and acceptable levels. The pipelay activity will only commence after the assessment is completed and any regulatory obligations are met.
Carbon	
How is the Bayu-Undan project supporting the Barossa project?	The Bayu-Undan field in Timor-Leste has a potential future role as a carbon capture and storage facility, following the end of natural gas production from that field. Santos proposes to repurpose the Bayu-Undan pipeline, which connects Darwin LNG to Bayu-Undan, and to transport CO2 from the Barossa project to Bayu-Undan via Darwin LNG. Front-end engineering design (**FEED**) commenced for the project in March 2022.

What are you going to do with the carbon from Barossa?	The CO2 from Barossa will be vented to the air via CO2 removal facilities on the FPSO and at DLNG. The CO2 emissions may be offset by Santos through purchasing carbon credits. Santos is also pursuing the Bayu-Undan Carbon Capture and Storage (**CCS**) project so that the CO2 can be safely and permanently stored in depleted reservoirs at Bayu-Undan instead of being vented to the air. The technical work is almost complete and Santos is working with the governments of Australia and Timor-Leste to progress regulatory frameworks and approvals.
How much CO2 will be captured by the Bayu-Undan CCS project?	The Bayu-Undan CCS project will be designed for initial injection and storage of approximately 2.3 million tonnes of CO2 per annum from Barossa.
How will you comply with the Safeguard Mechanism to ensure that Barossa is net zero emissions on day one of gas production scheduled for 2025?	The Government is still finalising the detailed guidelines for the Safeguard Mechanism. Santos expects to comply with the Safeguard Mechanism by storing the CO2 at the Bayu-Undan CCS project once the approvals are in place and the CCS infrastructure is operational. Before then, Santos will purchase carbon credits to offset reservoir CO2 emissions.

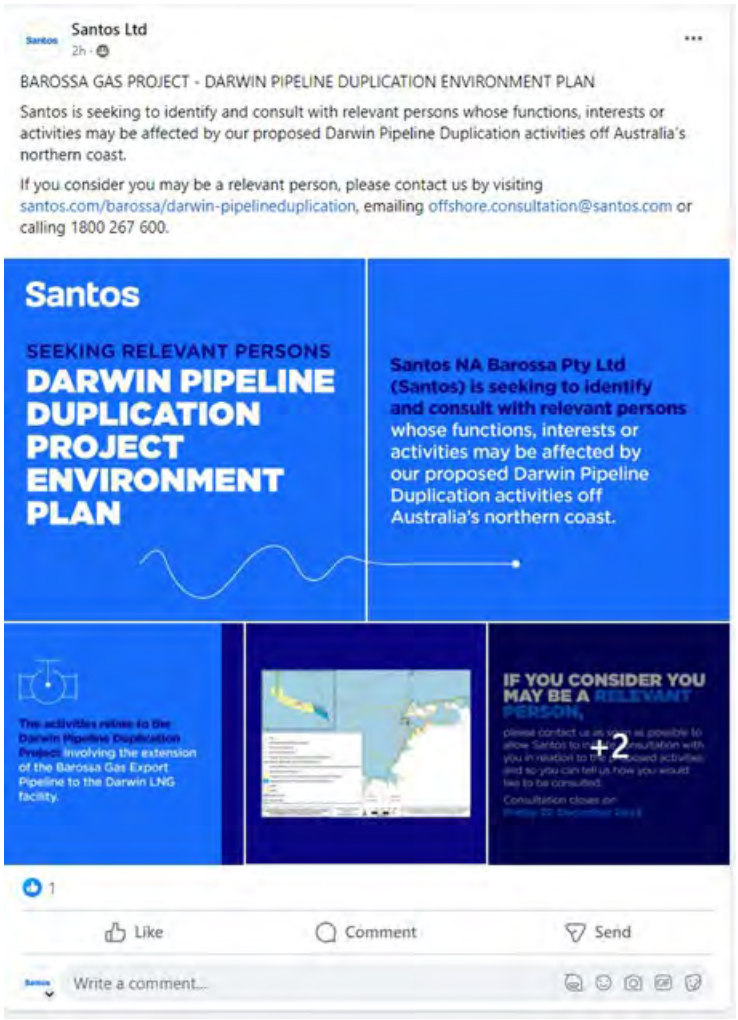
Appendix F Relevant Persons advertisements

Table 4-6 – Advertising Tiwi and Larrakia sessions

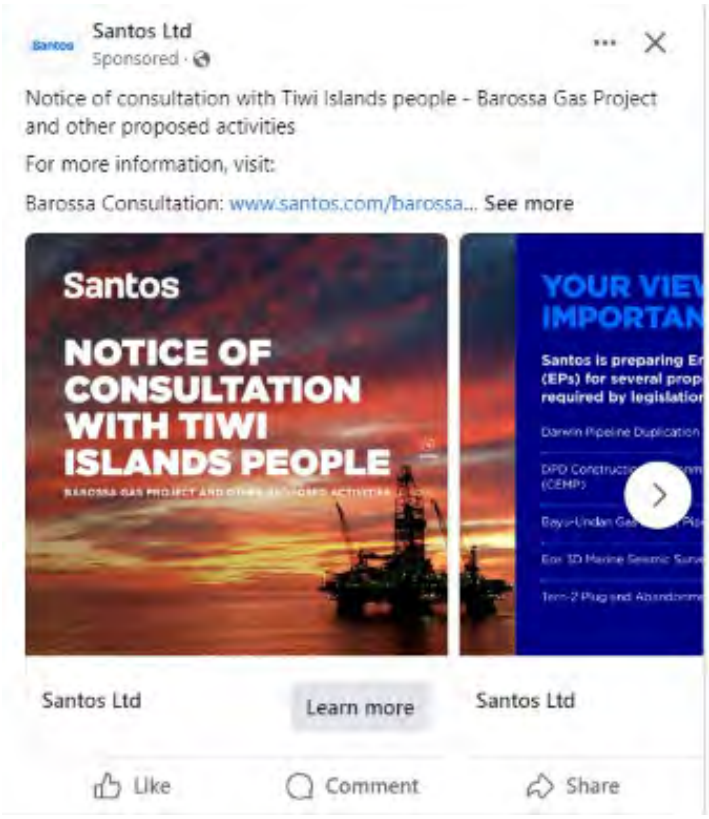
Tiwi December 2023 sessions

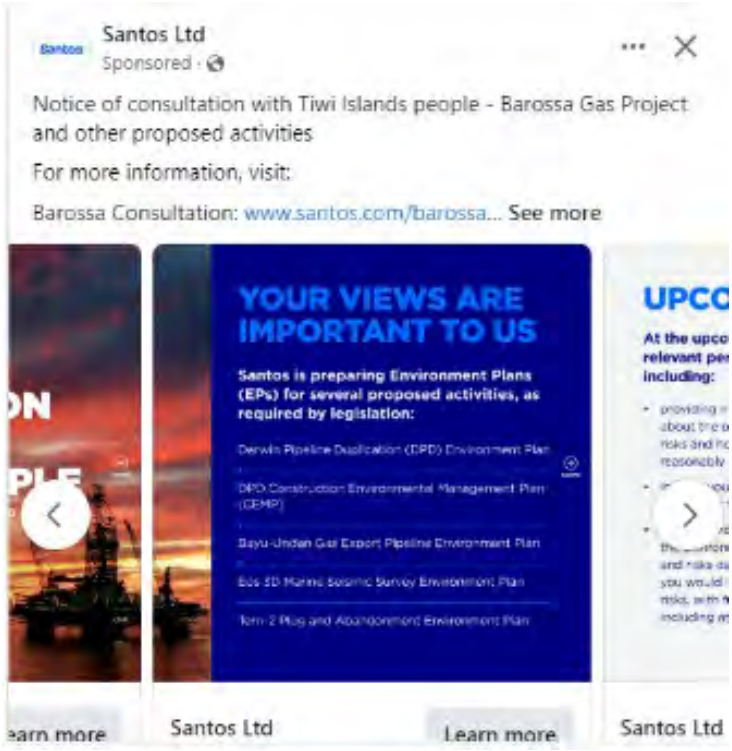
13 November 2023 – NT News

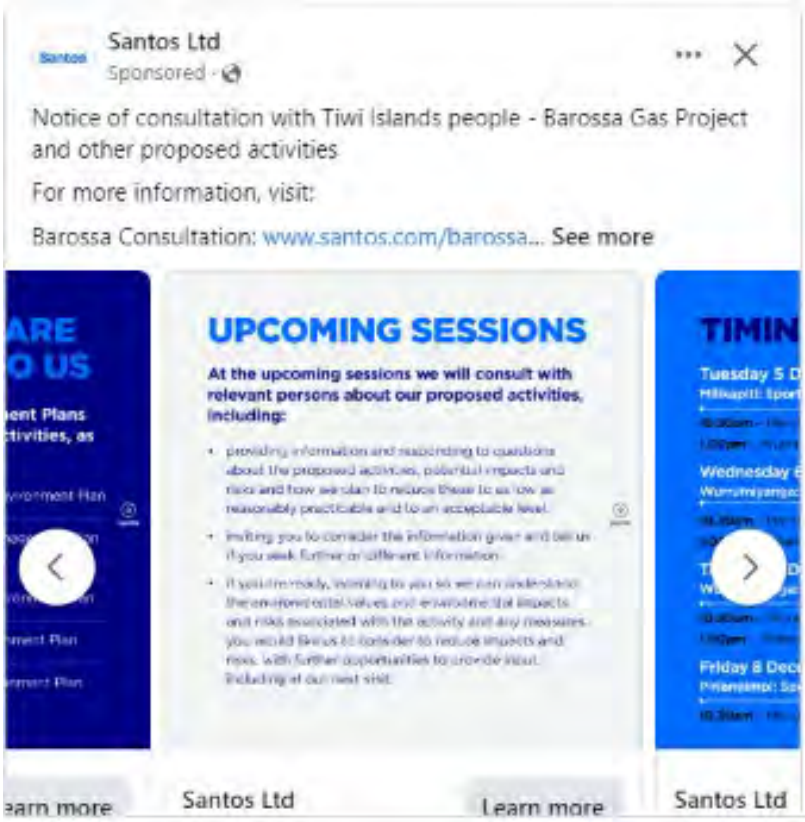
December – Social media Notice Tiwi Notice Board (Facebook)

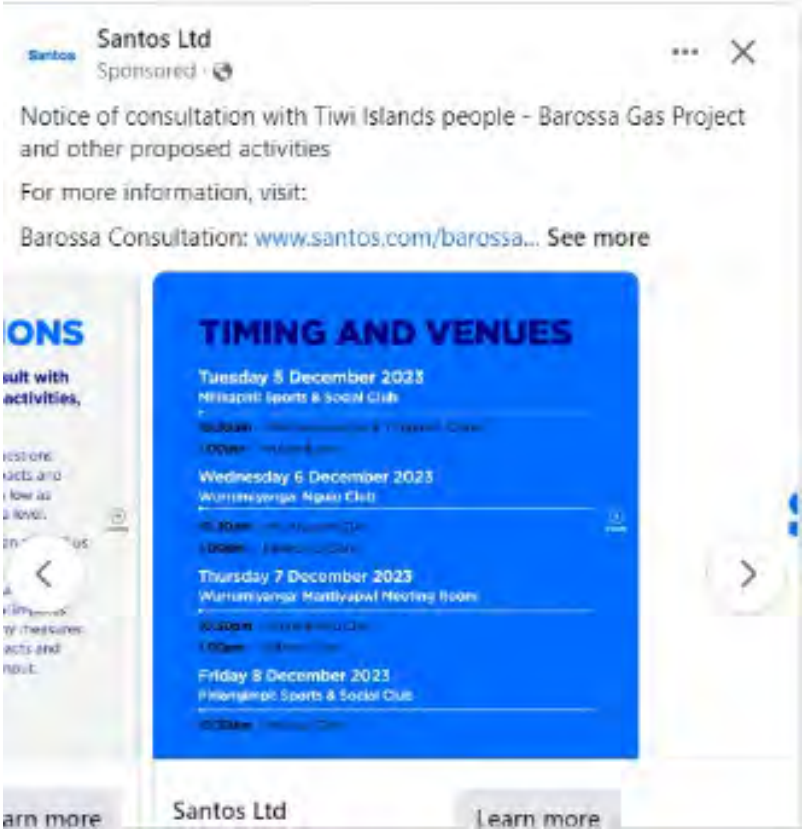


Geotargeted social media campaign November 14 - December 8 2023 – Darwin, Tiwi Islands, Northern Territory





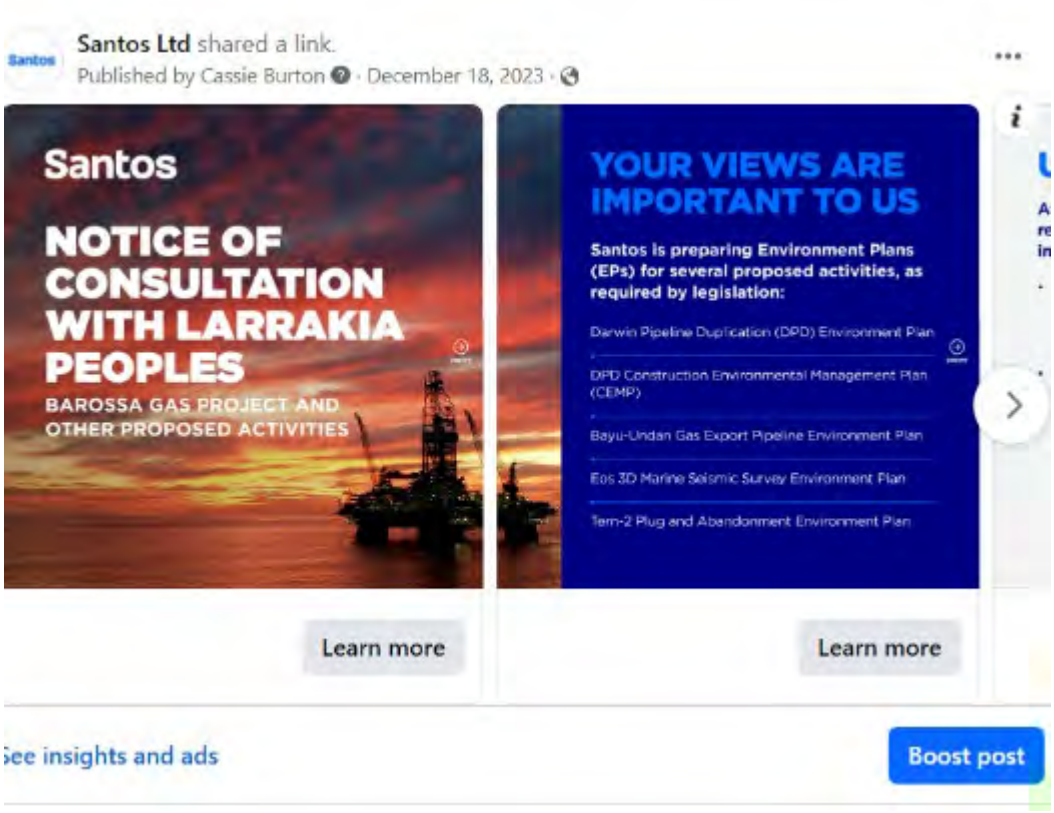


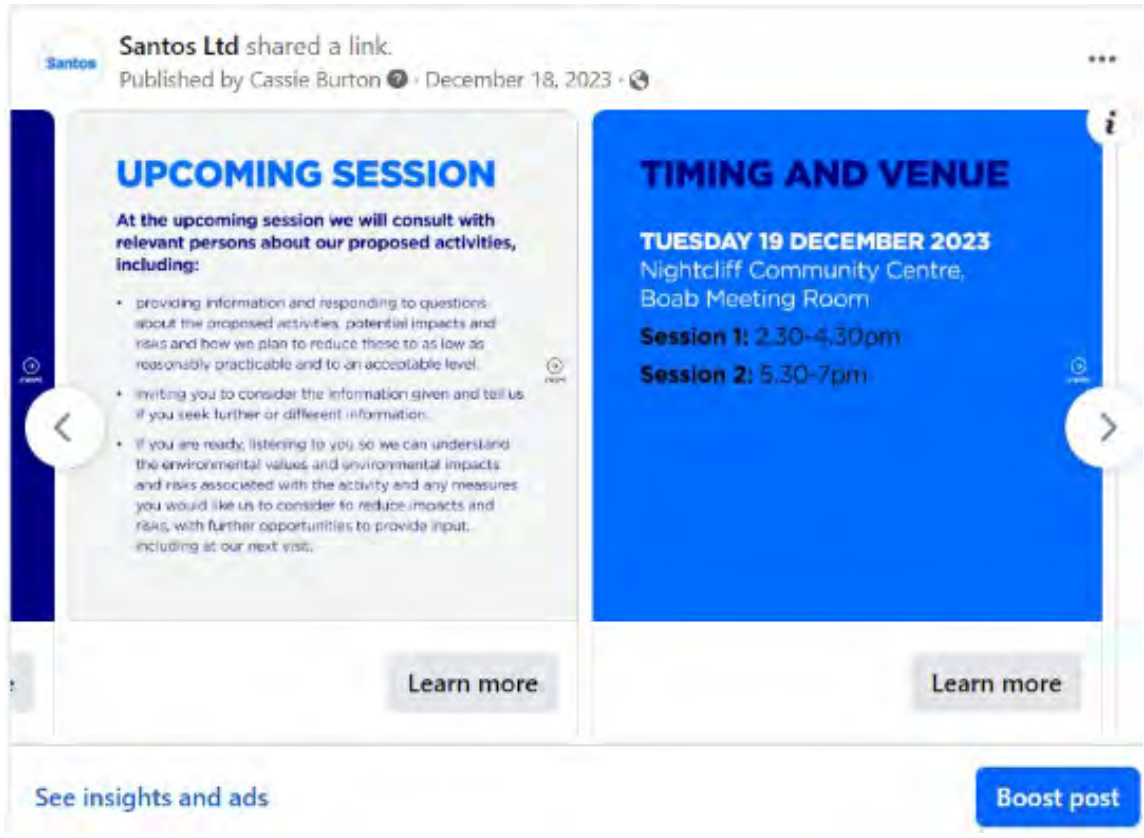


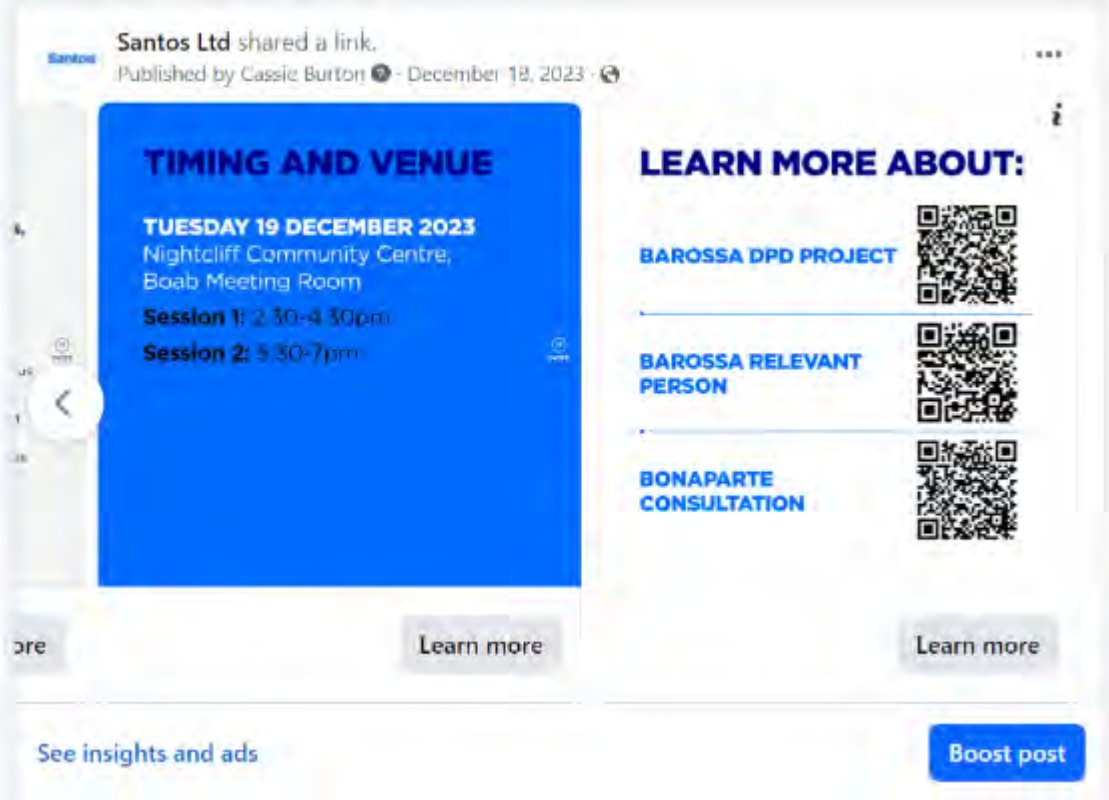
Larrakia December 2023 Sessions

19 December 2023 – NT News Full Page

Geotargeted social media campaign December 18 - 19 2023 – Darwin and surrounding areas (eg Burrundie and Kakadu, Tiwi Islands, Northern Territory)


Santos Ltd shared a link.
Published by Cassie Burton · December 18, 2023 ·
Santos
NOTICE OF CONSULTATION WITH LARRAKIA PEOPLES
BAROSSA GAS PROJECT AND OTHER PROPOSED ACTIVITIES
YOUR VIEWS ARE IMPORTANT TO US
Santos is preparing Environment Plans (EPs) for several proposed activities, as required by legislation:
Darwin Pipeline Duplication (DPD) Environment Plan
DPD Construction Environmental Management Plan (CEMP)
Bayu-Undan Gas Export Pipeline Environment Plan
Eos 3D Marine Seismic Survey Environment Plan
Tern-2 Plug and Abandonment Environment Plan
Learn more
Learn more
See insights and ads
Boost post


Santos Ltd shared a link.
Published by Cassie Burton · December 18, 2023 ·
UPCOMING SESSION
At the upcoming session we will consult with relevant persons about our proposed activities, including:
• providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
• inviting you to consider the information given and tell us if you seek further or different information.
• if you are ready, listening to you so we can understand the environmental values and environmental impacts and risks associated with the activity and any measures you would like us to consider to reduce impacts and risks, with further opportunities to provide input, including at our next visit.
TIMING AND VENUE
TUESDAY 19 DECEMBER 2023
Nightcliff Community Centre,
Boab Meeting Room
Session 1: 2.30-4.30pm
Session 2: 5.30-7pm
Learn more
Learn more
See insights and ads
Boost post


Santos Ltd shared a link.
Published by Cassie Burton · December 18, 2023 ·
TIMING AND VENUE
TUESDAY 19 DECEMBER 2023
Nightcliff Community Centre,
Boab Meeting Room
Session 1: 2.30-4.30pm
Session 2: 5.30-7pm
LEARN MORE ABOUT:
BAROSSA DPD PROJECT
BAROSSA RELEVANT PERSON
BONAPARTE CONSULTATION
Learn more
Learn more
See insights and ads
Boost post

Tiwi January/February 2024 Sessions

January 2024 Social Media Notice (same image as advertisement used)

22 January 2024 – NT News Full Page

19 February 2024 – NT News Full Page

26 February 2024 – NT News Full Page

Santos

NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing Environment Plans (EPs) for the following proposed activities, as required by legislation:

Darwin Pipeline Duplication (DPD) Environment Plan – this relates to the 23 km portion of the underwater DPD pipeline and supporting subsea infrastructure in Commonwealth waters 27 km south-west of the Tiwi Islands.

Production Operations Environment Plan – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Operation Environmental Management Plan (Production Operations) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory Waters and land, extending to the existing Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the sessions detailed in this notice through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

- Continue consulting with relevant persons about our proposed activities under the DPD EP, including:
  - providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
  - updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
  - if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Please note that this is the final consultation session for the DPD EP.

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level
  - inviting you to consider the information given and tell us if you seek further or different information

TIMING AND VENUES

Tuesday 5 March 2024, Milikapiti, Sports & Recreation Centre

10.30am – Marrikawuyanga & Yimpinan Clans
1.00pm – Wulirankuwu Clan

Wednesday 6 March 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan
1.00pm – Jikilaruwu Clan

Thursday 7 March 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Wurankuwu Clan
1.00pm – Malawu Clan

Friday 8 March 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

Tiwi March /April 2024 Sessions

February/March 2024 Social Media Notice (same image as advertisement used)

4 March 2024 – NT News Full Page

26 March 2024 – NT News Full Page

2 April 2024 – NT News Full Page

6 April 2024 – NT News Full Page

Santos

NOTICE OF CONSULTATION WITH TIWI ISLANDS PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing Environment Plans (EPs) for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EP or the OEMP listed above. Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

At the upcoming sessions we will:

- Consult with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:
  - providing information and responding to questions about the proposed activities, potential impacts and risks and how we plan to reduce these to as low as reasonably practicable and to an acceptable level.
  - inviting you to consider the information provided and tell us if you seek further or different information.

TIMING AND VENUES

Monday 8 April 2024, Pirlangimpi, Sports & Social Club

10.30am – Munupi Clan

Please note that in addition to consultation on the Production Operations EP and OEMP, Santos will also be consulting with the Munupi Clan on the Darwin Pipeline Duplication Project EP including:

- providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Tuesday 9 April 2024, Milikapiti, Sports & Recreation Centre

10.30am – Marrikawuyanga & Yimpinari Clans

1.00pm – Wulirankuwu Clan

Wednesday 10 April 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Mantiyupwi Clan

1.00pm – Jikilaruwu Clan

Thursday 11 April 2024, Wurrumiyanga, Mantiyupwi Motel

10.30am – Wurankuwu Clan

1.00pm – Malawu Clan

CONTACT US

T: 1800 267 600

E: offshore.consultation@santos.com

For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

Tiwi May 2024 Sessions

May 2024 Social Media Notice (same image as advertisement used)

8 May 2024 – NT News Full Page

15 May 2024 – NT News Full Page

20 May 2024 – NT News Full Page

Santos

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the existing Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication (DPD) Environment Plan (EP) – this relates to the 23 km portion of the underwater DPD pipeline and supporting subsea infrastructure in Commonwealth waters 27 km south-west of the Tiwi Islands.

We are currently consulting with Tiwi Islands people whose functions, interests or activities may be affected by activities proposed under the EPs or the OEMP listed above.

At all of the upcoming sessions we will:

Continue consulting with relevant persons about our proposed activities under the Production Operations EP and OEMP, including:

- providing responses to information provided and queries raised about the EP and OEMP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the EP and OEMP as a result of your information and comments before it is submitted to the regulator for assessment.
- If any input is outstanding, seeking your final input on possible consequences of the proposed Production Operations activity and any further measures you would like us to consider to reduce impacts and risks.

For the Munupi Clan on 17 May 2024: we will also continue consulting with relevant persons about our proposed activities under the DPD EP, including:

- providing responses to information provided and queries raised about the DPD EP by Tiwi Islands people, following previous Clan meetings.
- updating you about any measures we propose to adopt in the DPD EP as a result of your information and comments before it is submitted to the regulator for assessment.
- If any input is outstanding, seeking your final input on possible consequences of the proposed DPD activity and any further measures you would like us to consider to reduce impacts and risks.

Based on input from Tiwi Islands people, we will consult with you at the advertised sessions through Clan group meetings with videos and visual aids available.

TIMING AND VENUES

Monday 13 May 2024 - Milikapiti, Sports & Recreation Centre

10.30am - Marrikawuyanga & Yimpinari Clans
1.00pm - Wulirankuwu Clan

Wednesday 15 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Mantiyupwi Clan
1.00pm - Jikilaruwu Clan
Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

Thursday 16 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan

Friday 17 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan (This session has been rescheduled to May 17 at the request of the community. Note that this is the final Munupi Clan consultation session for the DPD EP.)

Tuesday 21 May 2024 - Pirlangimpi, Sports & Social Club

10.30am - Munupi Clan

Wednesday 22 May 2024 - Wurrumiyanga, Mantiyupwi Motel

10.30am - Wurankuwu Clan
1.00pm - Malawu Clan
These sessions have been rescheduled to May 21 and 22 at the request of the communities. Please note that these are the final consultation sessions for the Production Operations EP and OEMP.

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

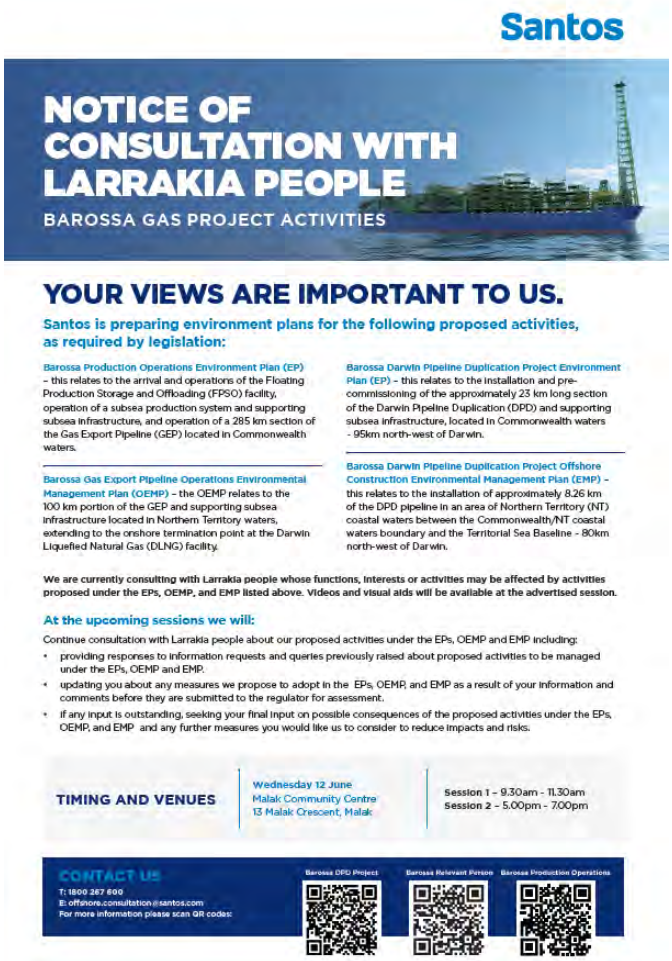
Larrakia June 2024 Sessions

7-12 June 2024 Geotargeted social media ads

1 June 2024 – NT News Full Page

5 June 2024 – NT News Full Page

8 June 2024 – NT News Full Page



Santos

NOTICE OF CONSULTATION WITH LARRAKIA PEOPLE

BAROSSA GAS PROJECT ACTIVITIES

YOUR VIEWS ARE IMPORTANT TO US.

Santos is preparing environment plans for the following proposed activities, as required by legislation:

Barossa Production Operations Environment Plan (EP) – this relates to the arrival and operations of the Floating Production Storage and Offloading (FPSO) facility, operation of a subsea production system and supporting subsea infrastructure, and operation of a 285 km section of the Gas Export Pipeline (GEP) located in Commonwealth waters.

Barossa Darwin Pipeline Duplication Project Environment Plan (EP) – this relates to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters - 95km north-west of Darwin.

Barossa Gas Export Pipeline Operations Environmental Management Plan (OEMP) – the OEMP relates to the 100 km portion of the GEP and supporting subsea infrastructure located in Northern Territory waters, extending to the onshore termination point at the Darwin Liquefied Natural Gas (DLNG) facility.

Barossa Darwin Pipeline Duplication Project Offshore Construction Environmental Management Plan (EMP) – this relates to the installation of approximately 8.26 km of the DPD pipeline in an area of Northern Territory (NT) coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline - 80km north-west of Darwin.

We are currently consulting with Larrakia people whose functions, interests or activities may be affected by activities proposed under the EPs, OEMP, and EMP listed above. Videos and visual aids will be available at the advertised session.

At the upcoming sessions we will:

Continue consultation with Larrakia people about our proposed activities under the EPs, OEMP and EMP including:

- providing responses to information requests and queries previously raised about proposed activities to be managed under the EPs, OEMP and EMP.
- updating you about any measures we propose to adopt in the EPs, OEMP, and EMP as a result of your information and comments before they are submitted to the regulator for assessment.
- if any input is outstanding, seeking your final input on possible consequences of the proposed activities under the EPs, OEMP, and EMP and any further measures you would like us to consider to reduce impacts and risks.

TIMING AND VENUES

Wednesday 12 June
Malak Community Centre
13 Malak Crescent, Malak

Session 1 - 9.30am - 11.30am
Session 2 - 5.00pm - 7.00pm

CONTACT US

T: 1800 267 600
E: offshore.consultation@santos.com
For more information please scan QR codes:

Barossa DPD Project | Barossa Relevant Person | Barossa Production Operations

Table 4-9 - Consultation Advertising

10 November 2023 – NT News

22 November 2023 – NT News

25 November 2023 – NT News

29 November 2023 – NT News

22 November 2023 – The Australian

6 December 2023 – The Australian

2 December 2023 – NT News

6 December 2023 – NT News

9 December 2023 – NT News

13 December 2023 – NT News

19 December 2023 – NT News

SEEKING RELEVANT PERSONS

DARWIN PIPELINE DUPLICATION PROJECT ENVIRONMENT PLAN

Santos

Santos NA Barossa Pty Ltd (Santos) is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Darwin Pipeline Duplication activities off Australia's northern coast.

The activities relate to the Darwin Pipeline Duplication Project involving the extension of the Barossa Gas Export Pipeline to the Darwin LNG facility. Santos is currently preparing:

- an Environment Plan (EP) relating to the installation and pre-commissioning of the approximately 23 km long section of the Darwin Pipeline Duplication (DPD) and supporting subsea infrastructure, located in Commonwealth waters where offshore petroleum activities are regulated by the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act); and
- an Offshore Construction Environmental Management Plan (EMP) which includes the installation of approximately 8.26 km of the DPD pipeline in an area covered by the *Petroleum (Submerged Lands Act) 1981* (NT) (PSL Act).

Activity location

These activities include those undertaken in Commonwealth waters, approximately 95 km north-west of Darwin and approximately 27 km south-west of the Tiwi Islands and those undertaken in an area of NT coastal waters between the Commonwealth/NT coastal waters boundary and the Territorial Sea Baseline with a width of approximately 5.5 km.

Activities will occur within an operational area defined as approximately a 3000 m radius around the pipeline end termination (PLET) and a 2000 m buffer either side of the DPD route. The operational area encompasses the installation of the DPD, as well as the movements of support vessels in the immediate vicinity of the pipelay vessel. Activity vessels and helicopters within the operational area are considered part of the activity under the DPD EP.

Summary of activities

A deepwater pipelay vessel will lay the DPD pipeline on the seabed at a rate of approximately 2 to 3 km per day, pending operational performance. A PLET will be installed at the end of the DPD pipeline in Commonwealth waters and a spool will be installed to connect the DPD pipeline PLET to the Barossa Gas Export Pipeline (GEP). Following installation, the DPD pipeline will be pre-commissioned for operations. This will include discharges of pre-commissioning fluids to the marine environment at the PLET in Commonwealth waters.

Helicopter flights to the deepwater pipelay vessel will occur approximately ten times a week at the peak utilisation, with approximately 70 helicopter movements in total.

This activity is currently planned to commence between Q3 2024 and Q2 2025, subject to obtaining the required approvals, but may occur earlier or later due to availability of installation vessels and equipment.

The environment that may be affected (EMBA) by proposed activities

Santos is assessing impacts and risks to the environment from these proposed activities, including on ecosystems (including people and communities), natural and physical resources, the qualities and characteristics of locations, places and areas and the heritage value of places. This will include assessment of the social, economic and cultural features of the environment.

The map identifies the operational area and the environment that may be affected (EMBA) by the proposed activities. The 'EMBA' represents the greatest geographical extent that could be affected by an unplanned 'worst case' oil spill scenario, before any measures to reduce the risks are considered.

Santos proposes to implement measures to reduce the impacts and risks of the activity. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable (ALARP) and to an acceptable level.

Consultation

Under environmental legislation, when Santos is preparing its EPs for these activities, it is required to consult with people and organisations who have functions, interests or activities that may be affected by the proposed activities. Functions, interests or activities may include those arising in relation to spiritual or cultural connections to land and sea country in accordance with Indigenous tradition; tourism; recreational and commercial fishing; other commercial or recreational activities and local communities that might be affected by our proposed activities (these are examples and not an exhaustive list).

Seeking information and what's next

In preparing an EP for submission to NOPSEMA, a titleholder must consult with each 'relevant person', including relevant Commonwealth, State and Northern Territory Departments or agencies and persons (or organisations) whose functions, interests or activities may be affected by the activity proposed to be carried out under an EP.

Your input is important to Santos:

- so that we can understand the environmental values in the operational area and the EMBA, and the environmental impacts and risks associated with the activity;
- to inform how consultation processes may need to be adapted for different relevant persons;
- to ensure that we provide information to people in an appropriate and accessible manner; and
- to assist with Santos' preparation of the EP.

More information on the proposed activities is available on our website.

Contact us

If you consider you may be a relevant person, please contact us as soon as possible to allow Santos to initiate consultation with you in relation to the proposed activities and so you can tell us how you would like to be consulted. Consultation closes on **Friday 22 December 2023**.

Santos is committed to undertaking genuine and meaningful consultation. We want to provide information for people to make informed assessments of the possible consequences of the proposed activities on them. Your input is important to us, and input will be considered in the development of our EP.

Visit **santos.com/barossa/darwin-pipeline-duplication**,
email **offshore.consultation@santos.com**
or call **1800 267 600** for more information, to self-identify as relevant person or to provide feedback.

Radio Ads:

27 November to 15 December 2023 Radio Darwin Hot 100

4 December to 22 December 2023 Radio Darwin Mix 104.9

Script:

Santos is now consulting with relevant persons for our proposed Darwin Pipeline Duplication activities.

The activities involve installing a pipeline in Commonwealth and NT waters north of Darwin to export natural gas from offshore reservoirs to Santos' DLNG facility.

If you consider you may be affected by these activities, please contact Santos as soon as possible. Consultation closes on the twenty-second of December 2023.

For more information, visit santos.com/barossa, phone 1800 267 600, or email offshore.consultation@santos.com.

Appendix G Maritime archaeology heritage assessment

BAS-210 0028 Rev 0

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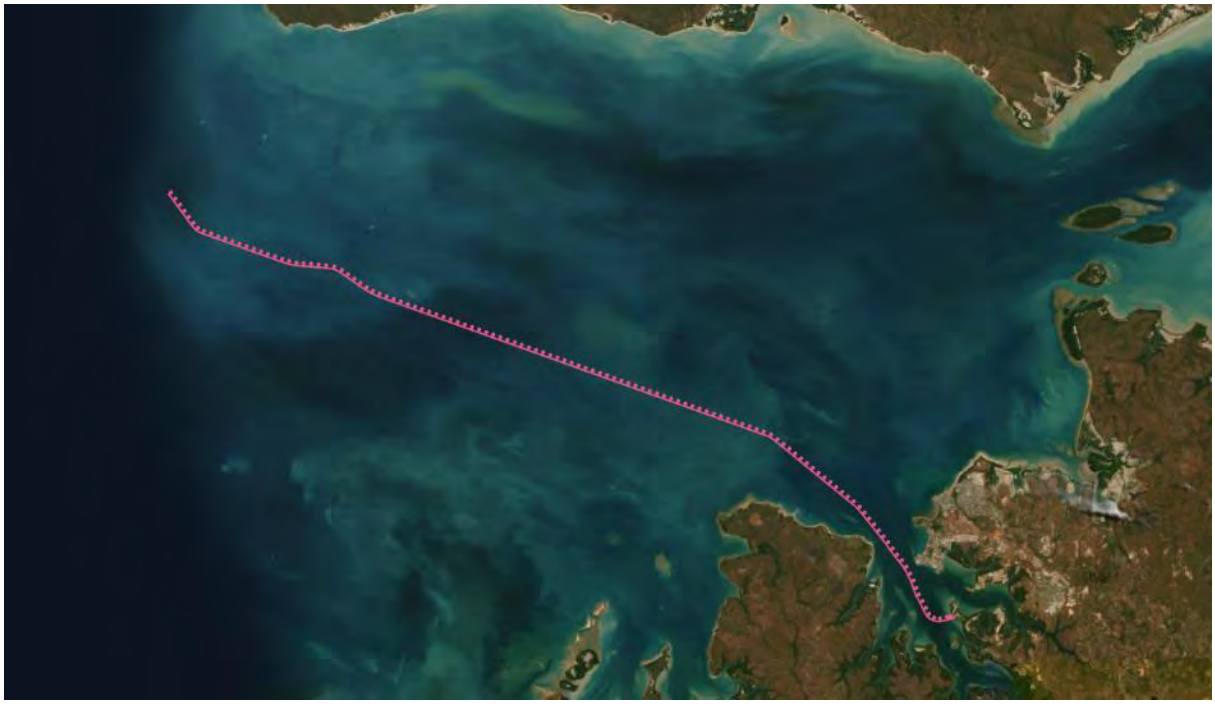
Santos (Barossa)
Gas Export Pipeline

Additional and Nearshore Barossa GEP Stage (Beagle Gulf and Darwin Harbour)



Maritime Heritage Assessment

Beagle Gulf and Darwin Harbour
Northern Territory

December 2022

Santos (Barossa) Gas Export Pipeline

Additional and Nearshore Barossa GEP Stage (Beagle Gulf and Darwin Harbour)

Maritime Heritage Assessment

Prepared for:

Santos Pty Ltd

By:

Cosmos Coroneos

Connor McBrian

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December 2022

Cosmos Archaeology Job Number J21/22b

Cover Image: Geophysical survey data overlaid on satellite imagery of Tiwi Islands and Darwin.

Revision	Description	Date	Originator	Reviewer	Approver
V0	Draft Report	8/02/2022	CM, CW	CW, CC	CC
V1	Draft with comments addressed	24/02/2022	CM	CC	CC
V2	Draft included review of additional geophysical data, review FUGRO report, and review of targets	26/05/2022	CM	CC	CC
V3	Inclusion of ROV survey results	06/07/2022	CM	CC	CC
V4	Client comments addressed, addition of anchoring and trenching zones	10/19/2022	CM	CC	CC
V5	Client comments addressed	05/12/2022	CM	CC	CC
V5.1	Appendix B comments addressed	08/12/2022	CM	CC	CC
V5.2	Finalised report	12/12/2022	CM	CC	CC

EXECUTIVE SUMMARY

Santos Pty Ltd is proposing to install a gas export pipeline (GEP) off the northwest coast of the Northern Territory (NT). The proposed GEP begins at the Barossa gas field, north of the Tiwi Islands, and extends south to feed the Darwin LNG plant, located in Middle Arm, Darwin Harbour. Two stages are proposed for the GEP. The first stage is a GEP from the Barossa gas field to a point at the existing Bayu-Undan to Darwin pipeline southwest of Bathurst Island. The second stage is to extend the GEP from this point to the Darwin LNG plant. This maritime archaeological heritage assessment (MAHA) examines the second stage, with the first stage being the subject of a separate report.

A review of historical sources, databases and marine geophysical information has found that within the study area, Larrakia and Tiwi people conducted maritime travel and subsistence activities – likely concentrated in coastal environments. Macassan trepang fishing and trade occurred throughout the 18th to early 20th centuries.

British exploration and surveying began in the early 19th century, following which a wide range of colonial shipping including Government and commercial cargo and passenger transport, fishing and pearling industry trade and transport, and recreational shipping occurred, from the establishment of colonial settlement in Darwin in the 1860s to present. In the 1870s and 1880s, three subsea telegraph cables were laid. Quarantine and leper station transport and service supply were established in Middle Arm throughout the late 19th to early 20th century.

The study area saw significant military action during World War II, including air and sea combat between Allied and Japanese forces, which resulted in the sinking of numerous ships and aircraft within Beagle Gulf and Darwin Harbour. Areas near and adjacent to the study area have been designated as live-fire ranges, and the pipeline route enters a gazetted air-to-air range, though it is unknown if live fire exercises have been undertaken.

There are seventeen located shipwrecks, six instances of maritime infrastructure, and five instances of UXO within the study area. There are no known aircraft wrecks or sea dumping sites within the study area. There are twenty-nine unlocated shipwrecks recorded to have wrecked within the vicinity of the study area. Any of these could possibly be wrecked within the study area. There are twenty-five known, but unlocated, aircraft wrecks in Beagle Gulf and Darwin Harbour that could potentially occur within the study area based on historical accounts of the wreck event and general wreck location.

The remains of these vessels, and their contents and fittings, are automatically protected under the Cwlth *Underwater Cultural Heritage Act 2018*. Remains within the coastal waters boundary (3nm seaward from the Territorial Sea Baseline 'TSB' – see Section 3.1) are protected under the NT *Heritage Act 2011,* and United States military shipwrecks and aircraft wrecks are protected under the US *Sunken Military Craft Act 2004.*

Side scan sonar data and MBES data from a marine geophysical survey conducted by Fugro in 2021 were reviewed, as well as 1 m resolution MBES data collected between 2011 and 2015, published by Geosciences Australia, covering the entirety of Darwin Harbour. Thirty-nine sonar and magnetometer contacts were identified from the Fugro survey data as being possibly cultural and hence of potential cultural heritage significance. These anomalies could be natural features, remains of anti-submarine defences, 19th century telegraph cables, shipwrecks, possible aircraft wreckage, debris fields, or isolated instances of debris and/or discard.

Santos has advised that an 1800 m wide corridor, located between KP 91.5 and the GEP terminus, has been proposed for anchoring of work vessels during GEP installation. Because this corridor is wider than the Fugro geophysical survey corridor, CA conducted a review of the Geosciences Australia MBES data to cover this gap. Clear evidence of eight shipwrecks were identified within the anchoring corridor. Two of these wrecks, USAT *Mauna Loa* and USAT *Meigs,* are protected under the NT *Heritage Act 2011* and may be protected under the

US *Sunken Military Craft Act 2004.* The remaining six shipwrecks identified during review of geophysical survey data are not protected under statutory regulations. No aircraft wrecks were identified within the anchoring corridor. In addition to the geophysical targets and Fugro geophysical survey targets identified, an additional 135 targets were identified within the gap between the geophysical survey corridor and the anchoring corridor. 90 of these targets are between KP 107 and 108, known to be the location of the WWII anti-submarine boom net moorings. It is believed that most, if not all, of these are large cement mooring blocks. The remaining 45 targets have been identified as most likely debris, with some instances of isolated discard and possible cable remains. These targets are scattered along the length of the anchoring corridor.

An ROV survey was conducted in June 2022 on 16 geophysical targets located within 50m of the proposed GEP route. Additionally, three transects were conducted on the likely location of WWII anti-submarine boom net moorings. The ROV survey identified three anti-submarine net mooring trots, Trots 16, 17, and 18. Trot 17 directly crosses the path of the proposed GEP route. The northern-most clump of Trot 16, identified as a repurposed ship's anchor, is located approximately 37m from the proposed GEP route, and the southernmost chain section of Trot 18 is located 32m from the proposed GEP route. The location of Clump 1, Trot 18, if still extant would likely be located within 25m of the proposed route.

In addition to the anti-submarine net trots, four isolated objects were observed during ROV surveys. Target MA_007 is located 6m from the proposed GEP route. Targets 174, MA_001, and NCL_SC_016 are located 15-35m from the proposed GEP route. While Target MA_001 was determined to be the remains of a modern buoy mooring, of minimal heritage significance. Targets 174, MA_007, and NCL_SC_016 could not be conclusively identified through ROV survey. Target 174 appears to be a ship's bollard with rope attached and MA_007 is a rectangular metal structure consisting of metal beams. NCL_SC_016 appears to be a subsea cable of unknown provenance but is not believed to be part of a DP&W or Telstra cable between Mandorah and Darwin, as the object is disarticulated and severed at both ends.

The identity, and hence cultural heritage significance of targets MA_007, 174, and NCL_SC_016, as well as other uninspected anomalies is not known. If identified geophysical anomalies and cultural heritage objects cannot be avoided, then a detailed heritage impact assessment will need to be conducted, consistent with the Heritage Branch of the Northern Territory Government (NT Heritage Branch) Archaeological Scope of Works.[1] This would inform a Maritime Heritage Management Plan, that would include specific mitigation measures and management recommendations for each anomaly, such as, but not confined to, archaeological recording, clearance, removal, and/or recovery. For example, any clearance of cultural material from the seabed should be recorded by a maritime archaeologist on-site. For the INPEX project, this involved maritime archaeologists with suitable diving qualifications embedded with the commercial dive teams.

It is recommended that if further remote sensing surveys of the proposed GEP are undertaken – i.e., to fill in data gaps or assess the risk of UXO – the additional survey data should be reviewed by a qualified maritime archaeologist.

In the unlikely event of significant maritime archaeological remains being discovered during the construction phase, an Unexpected Maritime Archaeological Finds Protocol to responsibly manage such finds should be prepared and implemented. If a Maritime Heritage Management Plan is deemed necessary, this would be a component of such a plan.

Based on the findings above, the recommendations made in this report are as follows:

[1] **NT Heritage Branch, 2021,** Archaeological Scope of Works: Gas export pipeline Barossa gas field to Middle Arm, Darwin Harbour.

Recommendation 1	***If feasible, the proposed GEP alignment be altered to avoid the WWII anti-submarine net mooring Trot 17 as well as cultural heritage objects identified at Target MA_007.***
Recommendation 2	***If potentially cultural anomalies and objects identified in this assessment are likely to be impacted, undertake a detailed heritage impact assessment by a qualified maritime archaeologist.***
Recommendation 3	***Establish no-anchoring zones around protected shipwreck locations, the anti-submarine net moorings, and unverified geophysical anomalies within the anchoring corridor.***
Recommendation 4	***If additional remote sensing data is collected for the proposed GEP it should be reviewed by a qualified maritime archaeologist.***
Recommendation 5	***Prepare and implement an Unexpected Maritime Archaeological Finds Protocol.***
Recommendation 6	***Review of this assessment if proposed alignment of pipeline changes.***

TABLE OF CONTENTS

Abbreviations

AHS SD	Australian Hydrographic Service Sea Dumping Database
AUCHD	Australasian Underwater Cultural Heritage Database
CA	Cosmos Archaeology Pty Ltd
GEP	gas export pipeline
GPS	global positioning system
IJNAF	Imperial Japanese Navy Air Force
IJN	Imperial Japanese Navy
KP	Kilometres along proposed pipeline route
.kmz	keyhole markup file
MHA	maritime archaeological heritage assessment
MBES	multi-beam echosounder
NT	Northern Territory
RAAF	Royal Australian Air Force
ROV	remotely operated underwater vehicle
SMCA	USA *Sunken Military Craft Act 2004*
SSS	side scan sonar
UCH	underwater cultural heritage
UCHA	Cwth *Underwater Cultural Heritage Act 2018*
USAAF	United States Army Air Force
USN	United States Navy
UXO	unexploded ordnance
WWII	World War II

1 INTRODUCTION

1.1 Background

Cosmos Archaeology (CA) has been commissioned by Santos Pty Ltd to undertake a maritime archaeological heritage assessment (MAHA) for the proposed installation of a gas export pipeline (GEP) off the northwest coast of the Northern Territory. The proposed GEP begins at the Barossa gas field, north of the Tiwi Islands, and extends south to feed the Darwin LNG plant, located in Middle Arm, Darwin Harbour. The first proposed route is a GEP from the Barossa gas field to a point at the existing Bayu-Undan to Darwin pipeline southwest of Bathurst Island. Cosmos Archaeology prepared and delivered a maritime heritage assessment for this offshore GEP route, issued for use 30 June 2022.[2]

The second proposed route is to extend the GEP to the Darwin LNG plant. This will include an additional 123 km of seabed pipeline, running through the harbour to the Darwin LNG plant, parallel to the existing Bayu-Undan pipeline.

This MAHA assesses only the second stage, the proposed new pipeline parallel with the existing Bayu-Undan pipeline from Beagle Gulf to the Darwin LNG plant. A MAHA for the first stage will be presented in a separate report.

1.2 The Maritime Archaeological Study Area

A project survey area has been provided by Santos Pty Ltd. This area has been subject to a marine geophysical survey, which will be discussed further in Section 6. The survey area consists of a corridor of variable width, between 700 and 180 m across, primarily around the centreline of the proposed pipeline alignment. The maritime archaeological study area defined by CA for this report is larger than the marine geophysical or project survey area. This is because the exact positions of many of the documented shipwrecks and aircraft wrecks in Beagle Gulf are not known, and some could potentially be located within a wider area. Historical or estimated positions for some wrecks could have a margin of error of a few kilometres. The maritime archaeological study area has been defined as a 1000 m buffer on either side of the proposed GEP centreline (Figure 1). The proposed pipeline route has been provided with markers (KPs) at each kilometre along the length from KP 0 at the junction with the GEP from proposal 1, to KP 122.475 where the pipeline terminates at the Darwin LNG plant.

[2] **Cosmos Archaeology, 2022,** *Santos (Barossa) Gas Export Pipeline, Original Barossa GEP Stage (Timor Sea and Tiwi Islands): Maritime Heritage Assessment.* Prepared for Santos Ltd (BAS 210-0017).

Figure 1: Maritime archaeological study area, 1000 m either side of pipeline centre route.

The coordinates for the survey area were provided by Santos Pty Ltd in the Geophysical survey reports for the Barossa Pipeline.[3] A .kmz file was provided by Santos displaying the centreline of the proposed pipeline route along with geotiff and shapefiles of the geophysical survey data. Additionally, the coordinates for the pipeline routes were provided by Santos Pty Ltd in the same report.[4]

1.3 Scope of the Study

This study addresses the Archaeological Scope of Works for the GEP Barossa Gas Field to Middle Arm, Darwin Harbour, prepared by the NT Heritage Branch in November 2021 and includes the following:

- Provide a list of located and potential maritime archaeological sites (including shipwrecks, aircraft wrecks and dump sites) known to be, or possibly located, within the study area
- Provide an outline of potential impacts from the pipeline installation.
- Provide a description of the different types of potential maritime archaeological sites on the seabed.
- Provide an expert analysis of geophysical survey data in regard to anomalies indicating potential maritime archaeological remains.
- Review of relevant legislative requirements.
- Provide mitigation measures for potential impacts on maritime archaeological remains.

This study examines maritime archaeological sites which are defined as wrecks (ship or aircraft) and associated material, dumped material, maritime infrastructure, and associated deposits on or under the seabed below the highest astronomical tide. While this report

[3] **Fugro, 2022,** *Barossa Pipeline to Shore Project – Survey Results Report – Offshore Geophysical Survey – (Work Package 1) North Route 2,* provided for Santos Pty Ltd. (BAS-200 0629).
[4] *Op. Cit.* **Fugro, 2022.**

addresses only the potential cultural heritage aspects of dumped and spent munitions, more information about unexploded ordnance (UXO) should be obtained from a suitably qualified UXO specialist or the Department of Defence. This heritage assessment should not be considered a UXO assessment.

1.4 Previous Work

CA has undertaken previous maritime cultural heritage surveys and assessments of the study area as part of the Darwin INPEX project between 2010 and 2014. The following is a list of reports previously completed by CA with a focus on the study area:

Cosmos Archaeology, 2011, *Ichthys Gas Field Development Project: Nearshore Development Area, Assessment of Marine Heritage Survey Methods,* report prepared for INPEX Browse Ltd.

Cosmos Archaeology, 2012, *Ichthys Project Darwin Harbour, East Arm Gas Export Pipeline: Assessment of Heritage Impact of 7 side scan targets.* Prepared for Tek Ventures Pty Ltd.

Cosmos Archaeology, 2014, *INPEX Ichthys LNG Project: Nearshore Development – Dredging. East Arm, Darwin Harbour, Northern Territory. Relocation of Heritage Objects and Removal of debris.* Prepared for Tek Ventures Pty Ltd.

Cosmos Archaeology, 2016, *INPEX Ichthys Project, Catalina Flying-Boat Monitoring 2012 to 2015,* Prepared for Tek Ventures Pty Ltd.

Cosmos Archaeology, 2022, *Santos (Barossa) Gas Export Pipeline, Original Barossa GEP Stage (Timor Sea and Tiwi Islands): Maritime Heritage Assessment.* Prepared for Santos Ltd.

2 METHODOLOGY

This desktop study has used various sources to prepare a list of known and potential shipwrecks, as well as other maritime archaeological sites in the study area (Table 1). Research is confined to what is available online and in the consultant's extensive library. Additionally, the Northern Territory Department of Heritage has been consulted for the location of sites which may not be publicly available.

Table 1: Historic resources consulted in this report.

Source	Description
Australasian Underwater Cultural Heritage Database (AUCHD)	The Australasian Underwater Cultural Heritage Database, maintained by the Commonwealth Department of Agriculture, Water and the Environment, is an online database of known and potential shipwrecks, aircraft wrecks and other maritime heritage sites and objects in Australian and Commonwealth waters.
Australian Government Department of Defence and Australian Hydrographic Service – Sea Dumping in Australia (AHS SD)	This database of sea dumping sites is managed by the Australian Government Department of Defence with information supplied by the Australian Hydrographic Service. http://www.hydro.gov.au/n2m/dumping/dumping.htm
NT Heritage Register	The NT Heritage Register is a register of all declared heritage places and objects (as declared under Part 2.2 of the NT *Heritage Act 2011*), and all heritage places and objects that have been nominated to the register. The register includes places and objects within NT waters. However, the public NT Heritage Register does not include heritage places and objects that are automatically declared under Part 2.1 of the NT *Heritage Act 2011*, including Aboriginal and Macassan places and objects.
Northern Territory Heritage Branch	Direct consultation with the Heritage Branch of the Northern Territory to determine the location of located heritage sites within the study area. *Email received from Heritage Branch on 28/3/2022 with recommendations for potential heritage items that might be located within study area.
Archival sources and heritage reports	A review of a wide range of primary and secondary historical sources held by NT Library and Archives, the National Library of Australia, the National Archives of Australia, and various published and unpublished heritage reports and articles was undertaken.
Previous reports completed by Cosmos Archaeology	A review of numerous reports on projects Cosmos Archaeology has conducted within the Northern Territory in Darwin Harbour and surrounds.

In addition to the heritage inventories, databases, historical resources, and previous reports, a detailed review of available geophysical survey data was also conducted. Section 6 details the results of the geophysical survey review and includes a table of targets identified to be potentially cultural in origin.

2.1 General Statements on site locations

Locations are known for 17 shipwrecks, six instances of maritime infrastructure, and four instances of UXO, however, there are many more sites that are known from the historical record but have not been located. At least 29 shipwrecks and 25 aircraft wrecks are known to have occurred within Beagle Gulf and Darwin Harbour but have not been located. The location data for these wrecks provided by heritage inventories and historical records are not always accurate.

As for the wrecks which have been located, designating accurate positions was not always possible as, in most cases, it is not known how their positions were recorded, such as with global positioning systems (GPS) or a compass/sextant. Furthermore, positions of known wrecks may have been taken off the charts and, therefore, reductions in precision due to plotting and scaling could be expected. Coordinates provided in some databases could also have been inferred from vague historical accounts which in fact could place the site within a relatively large area. This issue is proportionately compounded for sites that are lost at increasingly greater distances from the coast of Australia.

GPS coordinates have become increasingly reliable, but it must be noted that positions recorded with GPS in the 1980s to 1990s had accuracies of 100-300 metres. Those sites found and recorded by GPS closer to shore are likely to have had their location updated over time, but sites further from the coast and/or less accessible may still be listed with old and inaccurate coordinates. There are also different geodetic datums used by GPS units, but if datum is not recorded with the coordinates this can lead to errors when using the same coordinates with a different datum. User error can also occur when a recorder, or someone copying the location records, interprets the coordinates in the wrong style, such as reading coordinates in degrees, minutes, seconds rather than degrees and decimal minutes, for example. Based on these scenarios, it is safe to assume that there is always a degree of inaccuracy with the provision of site coordinates.

Australasian Underwater Cultural Heritage Database (AUCHD) [5]

Information presented in the AUCHD is compiled from each of the State and Territory historic shipwreck agencies or supplied by collecting institutions holding historic shipwreck objects. The integrity or source of the information held by these agencies is unknown. The size of the area in which an individual wreck could be found varies depending on the historical information available. Some wrecks which have been found have a latitude and longitude position, but the accuracy of that position could not be determined as the method used in obtaining the position is not known.

Department of Defence and Australian Hydrographic Service – Sea Dumping in Australia (AHS SD) [6]

The locations of sea dumped materials are provided by the Department of Defence Australian Hydrographic Service. Dumped materials of heritage value can include abandoned vessels and historic munitions, such as WWII-era aircraft components and Lend-Lease material.[7] It is unclear where the Australian Hydrographic Service obtained the positions of the dumped materials. It is important to note that these locations are where the materials were designated to be dumped, but it has been found that those dumping the materials may not have been particular about the final location. An example of this was identified in a previous CA study that found the Narrabeen Dumping Ground, Sydney (a ships graveyard), despite having a high concentration of wrecks within its boundary, also had a dense concentration of sites between four to five kilometres to the east, outside of the designated dumping area.[8]

[5] **Department of Agriculture, Water and the Environment, 2020**, *Australasian Underwater Cultural Heritage Database*, available at https://www.environment.gov.au/heritage/underwater-heritage/auchd
[6] **Department of Defence and Australian Hydrographic Service, 2020**, *Sea Dumping in Australia*, available at http://www.hydro.gov.au/n2m/dumping/dumping.htm
[7] **Cosmos Archaeology, 2014,** INPEX Ichthys LNG Project : Nearshore Development – Dredging. East Arm, Darwin Harbour, Northern Territory. Relocation of Heritage Objects and Removal of debris. Prepared for Tek Ventures Pty Ltd.
[8] **Cosmos Archaeology, 2007b,** Submarine Cable System, Landfall Option – Collaroy: Underwater Heritage Impact Assessment Baseline Review, report prepared for Patterson Britton and Partners.

3 LEGISLATION

The proposed subsea pipeline route passes through Northern Territorian waters. The NT Heritage Branch administers both the NT *Heritage Act 2011* and the Commonwealth *Underwater Cultural Heritage Act 2018* (under delegation from the Commonwealth Department of Agriculture, Water and the Environment). Both the *Heritage Act 2011* and the *UCH Act 2018* apply to NT waters including harbours, rivers, and estuaries.

3.1 Commonwealth *Underwater Cultural Heritage Act 2018*

The Commonwealth *Underwater Cultural Heritage* (UCH) *Act 2018* (replacing the *Historic Shipwrecks Act 1976*) provides for the protection, conservation, and management of Australia's historic shipwrecks, sunken aircraft, and other types of underwater cultural heritage. The Act is also designed to enable the cooperative implementation of national and international maritime heritage responsibilities, and to promote public awareness, understanding, appreciation, and appropriate use of Australia's underwater cultural heritage.

Under Part 1, Division 2 of the *UCH Act 2018*, underwater cultural heritage is defined as "any trace of human existence that has a cultural, historical or archaeological character; and is located under water." Traces of human existence are considered to be located under water whether they are located partially or totally under water, and whether they are under water periodically or continuously. A "trace of human existence" is further defined to include:

(a) sites, structures, buildings, artefacts and human and animal remains, together with their archaeological and natural context; and

(b) vessels, aircraft and other vehicles or any part thereof, together with their archaeological and natural context; and

(c) articles associated with vessels, aircraft or other vehicles, together with their archaeological and natural context.

Seabed pipelines and cables, and other installations that are placed on the seabed and are still in use, are not considered to be underwater cultural heritage under the Act.

Different articles of underwater cultural heritage are, or can be, protected under the *UCH Act 2018*, depending on the kinds of articles, their heritage significance, and their location. Part 2, Division 1 of the Act provides that certain articles of underwater cultural heritage are automatically protected, including:

(a) all remains of vessels that have been in Australian waters for at least 75 years;

(b) every article that is associated with a vessel, or the remains of a vessel, and that has been in Australian waters for at least 75 years;

(c) all remains of aircraft that have been in Commonwealth waters for at least 75 years;

(d) every article that is associated with an aircraft, or the remains of an aircraft, and that has been in Commonwealth waters for at least 75 years.

These articles of underwater cultural heritage are automatically protected whether or not the existence or location of the article is known, and even if the article is or has been removed from Australian or Commonwealth waters – after the passage of 75 years.

The term "associated with" is defined under Part 1, Division 2 of the Act whereby an article is considered to be associated with a vessel, aircraft, or other vehicle if the article:

(a) appears to have formed part of the vessel, aircraft or other vehicle; or

(b) appears to have been installed or carried on the vessel, aircraft or other vehicle; or

(c) is remains of humans or animals that appear to have been on board the vessel, aircraft or other vehicle; or

(d) appears to have been constructed or used by a person associated with a vessel.

"Australian waters" and "Commonwealth waters" have different meanings under the *UCH Act 2018* (Part 1, Division 2), whereby "Australian waters" extend from the seaward limits of a State to the outer limit of Australia's continental shelf, and "Commonwealth waters" extend from waters 3 nautical miles seaward of the Territorial Sea Baseline adjacent to the States and the NT – i.e., beyond State or Territory coastal waters – to the outer limit of Australia's continental shelf. Specifically, under Part 1, Division 2 of the Act:

"Australian waters" means:

(a) any waters on the landward side of the territorial sea of Australia that are not within the limits of a State; and

(b) the territorial sea of Australia; and

(c) the sea above the continental shelf of Australia; and

(d) the seabed and subsoil beneath any such sea or waters.

"Commonwealth waters" means:

(a) the territorial sea of Australia, other than coastal waters of a State or the Northern Territory; and

(b) the sea above the continental shelf of Australia; and

(c) the seabed and subsoil beneath any such sea or waters.

The Territorial Sea Baseline generally corresponds with the low water line along the coast, measured to the level of Lowest Astronomical Tide. However, in some cases, straight baselines have been established in areas where the coastline is deeply indented and cut into, or where there is a fringe of islands along the coast in its immediate vicinity.

The Territorial Sea Baseline in the region of the current study area incorporates straight baselines that connect the mainland to the Tiwi Islands. As such, the Beagle Gulf forms part of the coastal waters of the NT – see Figure 2.

Figure 2: Boundary of NT coastal waters around Darwin and Tiwi Islands.[9]

[9] **Australian Government Geoscience Australia**. **2022.** *Coastal Waters (State / Territory Powers) Act 1980.* Australian Marine Spatial Information System (AMSIS).

These definitions of Australian and Commonwealth waters in the *UCH Act 2018* have been carried over from the *Historic Shipwrecks Act 1976.* In its original form, the *Historic Shipwrecks Act 1976* applied to waters adjacent to a State's coasts upon Commonwealth proclamation and applied automatically to waters adjacent to a Territory's coast. In 1980, the Act was amended to apply to waters adjacent to a State only with the consent of the State, however, the automatic application to waters adjacent to a Territory's coast remained.

As such, NT waters – including coastal waters, bays, rivers, and bodies of water within the jaws of the land and inland waters, below the low water mark – i.e., all waters on the landward side of the NT coastal water boundary shown above in Figure 2.

The study area is situated within "Australian waters" as defined in the *Underwater Cultural Heritage Act 2018*, and as such, shipwrecks and all associated articles that have been in the water for over 75 years are automatically protected, and other forms of underwater cultural heritage sites can be declared protected.

Part 3, Division 2 of the *Underwater Cultural Heritage Act 2018* provides for the regulation of activities relating to protected underwater cultural heritage. Specifically, any conduct that has or is likely to have an adverse impact on protected underwater cultural heritage is prohibited unless carried out in accordance with a permit granted under the Act. Conduct is considered to have an adverse impact on protected cultural heritage if it:

(a) directly or indirectly physically disturbs or otherwise damages the protected underwater cultural heritage; or

(b) causes the removal of the protected underwater cultural heritage from waters or from its archaeological context.

3.2 Sunken Military Craft Act 2004 (USA)

The United States (US) *Sunken Military Craft Act* enacted in 2004 (as Title XIV of the "Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005") provides for the protection of sunken US military vessels and aircraft and the remains of their crews from unauthorized disturbance, salvage, or recovery. The Act applies to sunken US military ships and aircraft wherever located around the world and preserves the sovereign status of sunken US military vessels and aircraft by codifying both their protected sovereign status and permanent US ownership, regardless of the passage of time.

Under Section 1408 of the *Sunken Military Craft Act*, the term "sunken military craft" is defined as:

(A) any sunken warship, naval auxiliary, or other vessel that was owned or operated by a government on military non-commercial service when it sank;

(B) any sunken military aircraft or military spacecraft that was owned or operated by a government when it sank; and

(C) the associated contents of a craft referred to in subparagraph (A) or (B), if title thereto has not been abandoned or transferred by the government concerned.

"Associated contents" are defined as:

(A) the equipment, cargo, and contents of a sunken military craft that are within its debris field; and

(B) the remains and personal effects of the crew and passengers of a sunken military craft that are within its debris field.

Under Section 1402 of the *Sunken Military Craft Act* it is prohibited for any person to engage in or attempt to engage in any activity directed at sunken military craft that disturbs, removes,

or injures the craft, or possess any articles of sunken military craft, except in accordance with prior permission from the US Department of the Navy. As authorised by the Act, the Department of the Navy has established a permitting program to allow for controlled site disturbance of sunken military craft for archaeological, historical, or education purposes.

However, as sunken military craft and their associated contents represent a collection of non-renewable and significant historical resources that often serve as war graves, carry unexploded ordnance, or contain oil or other hazardous materials, it is the overall policy of the Department of the Navy that its sunken military craft remain in place and undisturbed, and non-intrusive *in situ* research is preferred. Sunken military craft that serve as the maritime grave sites of lost crew in particular are accorded the highest respect and protection by the Department of the Navy.

The Naval History and Heritage Command's (NHHC) Underwater Archaeology Branch (UAB) manages sunken military craft and research permit applications on behalf of the US Department of the Navy.

This Act is of relevance to this study as a number of US military craft – planes and vessels – were lost in the Northern Territory during WWII. As a matter of precedence, the INPEX project obtained a permit from the NHHC to relocate the remains of sunken USN Catalinas that were to be impacted by dredging off Blaydin Point.

3.3 Northern Territory *Heritage Act 2011*

The NT *Heritage Act 2011* (replacing the *Heritage Conservation Act 1991)* provides for the conservation of the Territory's natural and cultural heritage, including places and objects within NT waters.

The aim is achieved under the Act by:

(a) declaring places and objects of heritage significance to be heritage places and objects; and

(b) declaring classes of places and objects of heritage significance to be protected classes of heritage places and objects; and

(c) establishing the Heritage Council; and

(d) providing for heritage agreements to encourage the conservation, use and management of heritage places and objects; and

(e) regulating work on heritage places and objects; and

(f) establishing enforcement and offence provisions.

Under Part 2.1 of the NT *Heritage Act 2011*, all Aboriginal and Macassan archaeological places and objects are provided automatic protection under the Act, regardless of whether their existence or location is known.

An Aboriginal or Macassan archaeological places is defined under the Act as a place that:

(a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and
(b) has been modified by the activity of those people.

An Aboriginal or Macassan archaeological object is defined as a relic that:

(a) relates to the past human occupation of the Territory by Aboriginal or Macassan people; and
(b) is:

(i) in an Aboriginal or Macassan archaeological place; or
(ii) stored in a place in accordance with Aboriginal tradition, including, for example, in an Aboriginal keeping place.

A relic is defined under the Act as:

(a) an artefact or thing given shape by a person; or
(b) human or animal skeletal remains; or
(c) something else prescribed by regulation.

Under Part 2.2. of the NT *Heritage Act 2011,* other places and objects – i.e., non-Aboriginal and non-Macassan places and objects – can be declared by the Minister as protected heritage places and objects.

A place is defined as an area of land, and includes:

(a) a building or, a part of a building, on the place; and
(b) an item historically or physically associated with the place if the primary importance of the item derives (completely or partly) from that association; and
(c) equipment, furniture, fittings and articles on, or historically or physically associated with, the place.

Examples of places, as provided in the Act, include

1. A reef or a cliff, cutting, gorge, spring or other landform
2. A plant or animal community
3. Fossil beds
4. A park or garden
5. A lighthouse, church, homestead, railway station or gaol
6. A stock well
7. A cemetery, burial site or grave
8. An airstrip, magazine, storage tunnel or other military installation
9. The site of a shipwreck or aircraft crash.

The process for declaring heritage places and objects involves a nomination or Heritage Council initiation for assessment of the heritage significance – including aesthetic, historical, scientific, and social significance of a place or object. The Heritage Council then considers whether the place or object is of heritage significance and make a decision whether or not to recommend that the Minister declare the place or object to be a protected heritage place or object.

Under Part 5.5 of the Act, it is an offence to knowingly engage in conduct that results in damage to a heritage place or object, removes a part of the place, or removes a heritage object from the NT, unless the conduct is carried out in accordance with a relevant heritage agreement, work approval, repair order, or exemption.

3.4 UNESCO 2001 *Convention on the Protection of Underwater Cultural Heritage*

The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2001 *Convention on the Protection of the Underwater Cultural Heritage* is an international treaty that was developed to provide a common framework for States Parties on how to better identify, research, and protect underwater heritage whilst ensuring its preservation and sustainability. The UNESCO 2001 *Convention* consists of a main text that sets out basic principles for the protection of underwater cultural heritage and provides a detailed State cooperation system, and an Annex that outlines widely recognised practical rules for the treatment and research of underwater cultural heritage. The UNESCO 2001 *Convention* entered into force in 2009.

The Commonwealth of Australia supported the principles and drafting of the UNESCO 2001 *Convention* and is currently considering ratification of the Convention in accordance with requirements under Australia's *Treaty Making Guidelines.* The *Underwater Cultural Heritage Act 2018* was also developed specifically to align with the UNESCO 2001 Convention.

In 2010, the Commonwealth, States, and the NT signed the *Australian Underwater Cultural Heritage Intergovernmental Agreement* that would enable the Australian Government to ratify the UNESCO Convention 2001, should it so choose. The Agreement establishes the roles and responsibilities of Commonwealth, State and NT governments for the identification, protection, management, conservation, and interpretation of Australia's underwater cultural heritage. One of the key aims of the Agreement is for all parties to meet internationally recognised best practice management of Australia's underwater cultural heritage as outlined in the Rules in the Annex to the UNESCO 2001 *Convention*.

The main principles of the UNESCO 2001 Convention are as follows:

- Obligation to Preserve Underwater Cultural Heritage – States Parties should preserve underwater cultural heritage and take action accordingly. This does not mean that States would necessarily have to undertake archaeological excavations; they only have to take measures according to their capabilities. The Convention encourages scientific research and public access.
- *In Situ* Preservation as first option – The *in situ* preservation of underwater cultural heritage (i.e., in its original location on the seafloor) should be considered as the first option before allowing or engaging in any further activities. The recovery of objects may, however, be authorized for the purpose of making a significant contribution to the protection or knowledge of underwater cultural heritage.
- No Commercial Exploitation – The 2001 Convention stipulates that underwater cultural heritage should not be commercially exploited for trade or speculation, and that it should not be irretrievably dispersed. This regulation is in conformity with the moral principles that already apply to cultural heritage on land. It is not to be understood as preventing archaeological research or tourist access.
- Training and Information Sharing – States Parties shall cooperate and exchange information, promote training in underwater archaeology and promote public awareness regarding the value and importance of underwater cultural heritage.

The general principles concerning activities directed at underwater cultural heritage as contained in the Annex of the UNESCO 2001 *Convention* are

Rule 1. The protection of underwater cultural heritage through in situ preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorized in a manner consistent with the protection of that heritage, and subject to that requirement may be authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage.

Rule 2. The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods.

Rule 3. Activities directed at underwater cultural heritage shall not adversely affect the underwater cultural heritage more than is necessary for the objectives of the project.

Rule 4. Activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of objects. If excavation or recovery is necessary for the purpose of scientific studies or for the ultimate protection of the underwater cultural heritage, the methods and techniques used must be as non-destructive as possible and contribute to the preservation of the remains.

Rule 5. Activities directed at underwater cultural heritage shall avoid the unnecessary disturbance of human remains or venerated sites.

Rule 6. Activities directed at underwater cultural heritage shall be strictly regulated to ensure proper recording of cultural, historical and archaeological information.

Rule 7. Public access to in situ underwater cultural heritage shall be promoted, except where such access is incompatible with protection and management.

Rule 8. International cooperation in the conduct of activities directed at underwater cultural heritage shall be encouraged in order to further the effective exchange or use of archaeologists and other relevant professionals.

4 KNOWN AND POTENTIAL MARITIME ARCHAEOLOGY

4.1 Environment and Morphology

The proposed GEP route is planned to cross through Beagle Gulf, between the Tiwi Islands and the Northern Territory mainland, before turning south into Darwin Harbour to terminate at the Darwin LNG plant. Based on this route, the environment can generally be separated into two sections, Beagle Gulf and Darwin Harbour.[10]

4.1.1 *Beagle Gulf*

Beagle Gulf is characteristic of an offshore marine environment. The seabed in the vicinity of the proposed GEP route is composed of clay/silts and is featureless, though sand waves in places can reach 4.9m in height.[11] Geophysical surveys conducted confirm this characterisation of the area as a flat, featureless seabed at depths ranging 53 – 20m.

Beagle Gulf is exposed to greater swells and localised wind-generated waves than in Darwin Harbour. Relatively protected to the east and to some extent from the north by the Tiwi Island, the greatest fetch is from the western quadrants. Highest ambient wave activity takes place in the summer months when westerly winds are constant.[12] Wave heights during this season vary between 1 to 2m. Cyclones can increase wave heights by 50% to 100% with accompanying increases in current velocities.

Water temperature in the area is a constant 23.5°C with salinity close to the global average of 35 ppt.[13]

4.1.2 *Darwin Harbour*

Darwin Harbour is subject to large diurnal tidal variations (macrotidal). The difference between low and high tide during springs can be up to 7.5m.[14] This can result in current velocities between 2 to 2.5m/s (4 to 5kts). The tidal flows are the strongest in the narrowest sections of the harbour; the area most relevant to this study being the stretch of water between Tale Head and Emery Point (Larrakeyah).

The waters of Darwin Harbour are relatively well protected. The greatest fetch is to the northwest, from Beagle Gulf, thereby making the coastline around the western side of Wickham Point the most exposed within the study area. Having noted this, the ambient wave height in the harbour in the summer months can reach around 1m.[15] Waves generated by localised cyclonic activity can be much higher. It has been modelled that some waves reached heights of 4.5m in the harbour during Cyclone Tracy but were substantially lower – 0.7m – within the inner parts of the harbour.[16] During such events, tidal heights can potentially increase up to 9.1m LAT, which is around 2m higher than the highest annual spring high tide.[17]

Water temperatures in the near shore development area of Darwin Harbour are typically high, ranging from 23.5°C to 32.7°C.[18] Salinity varies within the harbour during the year. The large influx of fresh water from adjacent streams during the wet season is responsible for this variation. During the months of February and March, salinity levels can be as low as 19 parts per thousand (ppt), while during the dry season levels rise to around 37 ppt.[19] The global

[10] **Cosmos Archaeology, 2011,** Ichthys Gas Field Development Project: Nearshore Development Area, Assessment of Marine Heritage Survey Methods, report prepared for INPEX Browse Ltd.
[11] **Fugro Survey Pty Ltd, August 2008** Volume 1a, 2-40.
[12] *Op. Cit.* **Fugro, 2008**:2-36.
[13] *Op. Cit.* **Fugro, 2008**:2-42.
[14] **INPEX**, **2010**, Ichthys Gas Field Development Project: Draft environmental impact statement, 33.
[15] *Op. Cit.* **INPEX, 2010:**56.
[16] *Op. Cit.* **INPEX, 2010:**56.
[17] *Op. Cit.* **INPEX, 2010:**56.
[18] *Op. Cit.* **INPEX, 2010:**62.
[19] *Op. Cit.* **INPEX, 2010:**62.

average for salinity is 35 ppt. During the wet season, water stratification can occur where freshwater intrusions from the adjoining streams can form a layer over the denser saline waters of the harbour.

The large tidal variations within the harbour result in the waters remaining well oxygenated, ranging from 74 to 96%.[20] There are some differences in dissolved oxygen levels from the mouth of the harbour where they are the highest, to waters closer to the streams at low tide where they are the lowest. Higher dissolved oxygen levels are also found closer to the water surface than at the base of the water column.

Darwin Harbour is well known for its poor visibility for diving due to suspended sediments in the water. Turbidity is at its highest during wet season spring tides due to the capacity of the spring water flows to mobilise sediments that have been flushed into the harbour from the land.[21] During these times, light levels at the bottom of the harbour can be 1% of that at surface levels.

The strong tidal flows coupled with the large volumes of water flowing out from the streams entering the harbour, have had a scouring effect on the seabed, creating and/or enlarging relatively deep channels, which are drowned Pleistocene river courses.

The main channel through Darwin Harbour mostly ranges between 15-25m deep, with a maximum depth of 36m. At Wickham Point the channel forks, with the western and shallower channel/tributary trending southwards into the Middle Arm. A smaller channel separates Channel Island from Wickham Point.[22] The eastern and deeper channel shapes a course to the southeast between East Arm to the north and Wickham and Blaydin Points to the south.

The sides of the main drainage channels are mostly rocky and the sediments within the study area are coarse sands with some gravels, silt and clay.[23] In the portion of the study area between Larrakeyah and Mica Beach, the seabed is more gravelly and provides a thin covering over sandstone and phyllite formations of which large weathered sand veneered expanses are also exposed in the form of relatively flat/level pavements. [24] At the entrance to Darwin Harbour there are numerous cemented ridges.[25] The thickness of the sediments over the sandstone and phyllite substrate varies. In the same area, where there are extensive areas of exposed sand veneered bedrock, there are pockets of sediments up to 6m thick.[26]

A sandbank is also located in the study area between Channel Island and the Darwin LNG plant on Wickham Point.[27] The bank is over 1.5km long, 12m high and has a minimum of 0.6 m of water over it.

Sand waves are also present throughout the northern part of the entrance to Darwin Harbour.[28] Silty to sandy seabed is present in the study area close to the landfall of the proposed pipeline with coarser sediments covering shallower waters towards the south.[29]

Silty seabed surfaces are found in the shallower waters adjacent to the mangrove flats around Wickham Point; their occurrence signifying sheltered waters not greatly affected by strong tidal currents.[30] More carbonate (shell) based sediments mixed with sand and gravels

[20] *Op. Cit.* **INPEX, 2010:**62.
[21] *Op. Cit.* **INPEX, 2010:**63.
[22] *Op. Cit.* **INPEX, 2010:**Figure 3-11
[23] *Op. Cit.* **INPEX**, **2010**:64, 69 and Figure 3-16.
[24] *Op. Cit.* **INPEX, 2010:**71.
[25] **Fugro Survey Pty Ltd March 2010** Report on the Offshore Pipeline Route Unexploded Ordnance (UXO) Survey. Volume 1 – Survey Results, 5
[26] *Op. Cit.* Fugro Survey Pty Ltd, August 2008 Volume 1a, 2-25
[27] *Op. Cit.* **Fugro, 2008**:2-32.
[28] *Op. Cit.* **Fugro, 2008**:2-54.
[29] *Op. Cit.* **Fugro, 2008**:2-36.
[30] *Op. Cit.* **Fugro, 2008**:2-19.

are situated in the spits and shoals close to the entrance to the harbour.[31] Mudflats are also present, adjacent to the western shore of Wickham Point. [32]

4.2 Cultural Activities in Darwin Harbour and Beagle Gulf

4.2.1 *Larrakia*

The Darwin region was traditionally occupied by the Larrakia people, whose country stretches along the NT coast from Finniss River and Fog Bay in the west to Gunn Point and Adelaide River in the east and extends inland along the Charlotte River. The waters of Darwin Harbour, Bynoe Harbour, Shoal Bay, Adam Bay, and parts of Beagle Gulf also form part of Larrakia country. Larrakia people refer to themselves as "Saltwater People," and traditional society and subsistence was largely centred around their coast and sea country.

Regional archaeological evidence suggests that Larrakia people have occupied the NT coastal region for at least 7-8,000 years, throughout the early to recent late Holocene, and likely further back through periods of lower sea level during the terminal Pleistocene when Darwin Harbour would have been a down-cut river valley.[33]

Various ethno-historical accounts dating back to the 19th century describe extensive Larrakia knowledge of the marine environment and a long tradition of the use of bark canoes and dugout canoes for estuarine and coastal subsistence fishing and hunting of dugong and turtles. Canoes were also used to travel throughout the waters of Larrakia sea country, and occasionally to travel and trade with neighbouring groups along the NT coast and across the Beagle Gulf to the Tiwi Islands.[34]

4.2.2 *Macassan traders*

In the early to mid-1700s, Indonesian traders began visiting parts of the northern coast of Australia to fish for trepang – sea cucumber or *bêche-de-mer* – prized for its culinary and medicinal values in Chinese markets. The term "Macassan" – originally denoting people from Macassar, the major fishing port in south-west Sulawesi, is generally used to apply to all the trepangers who came to Australia, even though some were from other islands in the Indonesian Archipelago, including Timor, Rote and Aru.

Throughout the latter 1700s to early 1900s, fleets of Macassan *perahus* or *praus*, timber multi-hulled sailing vessels, travelled to the north Australian coast with the north-westerly winds during the tropical wet season, and departed with the south-easterly winds of the dry season. A single fleet could be composed of thirty or more vessels, and in some periods up to 200 *perahus,* amounting to over 2,000 men, were estimated to be fishing the coastline from Cobourg Peninsula to south-eastern Arnhem land.

The sea route from the Indonesian archipelago took the Macassans through the Timor Sea and along the north coast of the Tiwi Islands and on to the Cobourg Peninsula. There is no clear evidence in historical accounts that Macassan trepangers travelled into Beagle Gulf or Darwin Harbour; however, artefacts believed to be of Macassan origin have been found on beaches in the wider Darwin region, including a cast iron swivel gun collected from an

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[31] *Op. Cit.* **Fugro, 2008**:2-55.
[32] *Op. Cit.* **INPEX**, **2010:**Figure 3-16.
[33] **Burns, T. 1999.** "Subsistence and settlement patterns in the Darwin coastal region during the late Holocene period: a preliminary report of archaeological research." *Australian Aboriginal Studies.* Issue 1; pp. 59-70.; **Brockwell, S., P. Faulkner, P. Bourke, A. Clarke, C. Crassweller, D. Guse, B. Meehan & R. Sim. 2009.** "Radiocarbon dates from the Top End: A cultural chronology for the Northern Territory coastal plains." *Australian Aboriginal Studies*. Volume 1, pp. 54–76.; **Sim, R. & L. A. Wallis. 2008.** "Northern Australian offshore island use during the Holocene: The archaeology of Vanderlin Island, Sir Edward Pellew Group, Gulf of Carpentaria." *Australian Archaeology*. Volume 67, pp. 95–106.
[34] **Foelsche, P. 1882.** "Notes of the Aborigines of North Australia." *Transactions of the Royal Society of South Australia.* Vol 2; pp, 1-18.; **Hodgson, R. 1997.** *Aboriginal use of natural resources in the Darwin region – past and present.* Report to the Australian Heritage Commission. **Parkhouse, T. A. 1895.** "Native tribes of Port Darwin and its neighbourhood." *Australasian Association for the Advancement of Science.* Vol. 6; pp. 638-647.;

unknown location on the shoreline of Darwin Harbour in 1908, and a bronze swivel gun found at Dundee Beach, south-west of Darwin in 2010.[35]

4.2.3 *European exploration*

The first documented European exploration of Darwin Harbour and Beagle Gulf occurred in 1839 by a British Admiralty survey expedition led by Royal Navy Commander John Clements Wickham and Lieutenant John Lort Stokes aboard the HMS *Beagle.*

The harbour and surrounding coastline were surveyed in detail (see Figure 3) and numerous features named – Wickham named the harbour Port Darwin after famed naturalist Charles Darwin, with whom he had sailed on earlier expeditions of HMS *Beagle,* Beagle Gulf was named after the vessel itself. Wickham and Stokes both wrote of the advantages of the protected nature of the "splendid stretch of water" of Port Darwin; however, the area saw little further visitation for several decades.[36]

Figure 3: Chart of Beagle Gulf, Port Darwin, and surround from HMS Beagle 1839 survey.[37]

[35] **Clark, M. & S. K. May (eds). 2013** *Macassan History and Heritage – Journeys, Encounters and Influences.* Australian National University Press, ACT.; **Coroneos, C. 1996.** "The shipwreck universe of the Northern Territory." *Bulletin of the Australian Institute for Maritime Archaeology.* Vol. 20; pp. 11-22.; **Jung, S. 1992.** *Annotated Bibliography of Macassan Perahu Wrecks & Sightings.* Maritime Archaeology & History, Northern Territory Museum of Arts and Sciences, Darwin, NT. **Jateff, E. 2011.** "An Oddity in South Australia. An Indonesian imitation swivel gun?" *AIMA Newsletter.* Volume 30, Issue 1.; **MacKnight, C. C. 1976.** *The Voyage to Marege; Macassan Trepangers in Northern Australia.* Melbourne University Press, VIC.

[36] **Bolton, G. C. 1967.** "Stokes, John Lort (1812-1885)." *Australian Dictionary of Biography.* Vol. 2. Australian National University Press, ACT.; **Ingleton, G. C. 1944.** *Charting a Continent – A Brief Memoir on the History of Marine Exploration and Hydrographical Surveying in Australian Waters from the Discoveries of Captain James Cook to the War Activities of the Royal Australian Navy Surveying Service.* Sydney.; **Morrison, A. A. 1967.** "Wickham, John Clements (1798-1864)." *Australian Dictionary of Biography.* Vol. 2. Australian National University Press, ACT.

[37] **Great Britain. Hydrographic Department / Richards, G. H., J. L. Stokes, E. Weller & J. C. Wickham. 1839.** *Australia - N.W. coast, Port Darwin and adjacent inlets.* Published at the Admiralty 1st March 1870 under the Superintendence of Capt'n G.H. Richards, R. N., F. R. S., Hydrographer, London, UK.

4.2.4 *Initial colonial settlement at Port Darwin*

In the late 1850s, the beginnings of a network of telegraph lines linking capital cities across Australia was being established, and speculation soon arose regarding a possible international connection between Australia and the new telegraph line from Europe to the East Indies. Competition between the Australian colonies over the route was fierce, with both the Victorian and South Australian governments organising expeditions to cross the continent from south to north and identify potential overland telegraph routes. In 1863, following John McDouall Stuart's successful expedition from Adelaide to Chambers Bay (east of Darwin), the SA Government annexed the Northern Territory – an area that had previously been a nameless part of New South Wales, with the aim of securing the land as a potential telegraph bridge to Asia and thence Europe. In 1865, the Australian Parliament authorised the construction of a telegraph line between Adelaide and Port Augusta (322km north of Adelaide), strengthening SA's position in the race for the cross-country telegraph connection.

In the meantime, SA Government surveyors were sent to the north coast of the NT to select a potential landing site for the telegraph and establish a supporting settlement. The first site, selected in 1864 by Surveyor Boyle Travers Finniss at Escape Cliffs near the mouth of the Adelaide River, was abandoned in 1867. After examination of several other suggested areas, a settlement was finally laid out by Surveyor-General George Goyder at Fort Point headland in Port Darwin in 1869. The township was named "Palmerston" after the then British Prime Minister Lord Palmerston.

The final telegraph contract was secured in 1870 when the SA Government proposed to extend the line from Port Augusta to Palmerston and the British-Australian Telegraph Company agreed to lay the undersea cable from Java to Port Darwin.[38]

The undersea cable was constructed in 1871 by a team of marine engineers and electricians from the British Telegraph Construction and Maintenance Company (Telcon) and the British-Australian Telegraph Company (BAT). The cable was first landed at Palmerston, at Fort Point – considered the most suitable site for the telegraph buildings – before being laid out across the seabed to Banjowangie, Java. The landward-end of the cable was carried from cable-ship SS *Hibernia* to the shore in bights held up by boats, hauled up the beach to the cable-house and buried in a shallow trench (see Figure 5 and Figure 6). Hibernia then commenced paying the cable out along the seabed; travelling north-east to east around Point Emery, then northwards past Fannie Bay and gradually veering north-east towards the entrance to the harbour (see Figure 4). The cable consisted of seven small copper wires – including a central wire with six twisted around it – insulated by gutta-percha latex and tarred hemp, covered with a sheathing of galvanised iron wire and another outside covering of tarred hemp. The cable was ¾" (19 mm) in diameter in the deep-sea sections, 1" (25 mm) in diameter in the intermediate sections and 3" (76 mm) in diameter at the shore end.[39]

In 1879, a duplicate telegraph cable was laid between Darwin and Java, which allowed for increased telegraph capacity and the establishment of a day and night service between Australia and Britain. The second cable was again laid by Telcon, this time under contract to the Eastern Extension Australasia and China Telegraph (EEACT) Company, which had absorbed BAT in 1873. The duplicate cable was of the same composition as the original

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[38] **Clune, F. 1955.** Overland telegraph: the story of a great Australian achievement and the link between Adelaide and Port Darwin. Angus and Robertson, Sydney, NSW.; **Cross, J. 2011.** Great Central State – The Foundation of the Northern Territory. Wakefield Press, South Australia. **Reece, R. 1989.** "Palmerston (Darwin); Four Expeditions in Search of a Capital." Statham, P. (ed.) The Origins of Australia's Capital Cities. Cambridge University Press, Cambridge, UK.;

[39] **Anon 23 January 1872** "The Australian Submarine Cable." *The Argus.*; **Nicols, J. 1870-1874** *Notebook.* Transcribed by Vickers, M. 2005. http://atlantic-cable.com/CableStories/Nicol/index.htm; **NT Heritage Branch. 2019.** *The Darwin Subsea Telegraph Cables – Heritage Assessment Report.*; **Wildey, W. B. 1876.** *Australasia and the Oceanic Region, With Some Notice of New Guinea, From Adelaide – Via Torres Straits – to Port Darwin, Thence Round West Australia.* George Robertson, Melbourne, Victoria.

1871 cable, and was laid out in the same manner; this time with the majority of the work being carried out by cable ship SS *Siene.*[40] The duplicate cable was laid to the west of the 1871 cable within Darwin Harbour, before crossing over the 1871 cable towards the harbour entrance and then running along the northern side of the 1871 cable through Beagle Gulf (see Figure 4).

In 1884, EEACT decided to renew the eastern end of the original 1871 Darwin to Java telegraph cable. EEACT had found that this section of cable, particularly where it passed through shallow waters, was being frequently damaged by marine borers – namely teredo worm (*Teredo navalis*). A new cable was thus designed with a patent brass ribboned core to prevent teredo attack and was laid out by cable ship SS *Siene* in early 1884. The replacement cable was laid between the 1871 cable and the 1879 duplicate cable through Darwin Harbour, crossing over near the harbour entrance and then running along the southern side of the 1871 cable (see Figure 4). Some broken sections of the original 1871 cable were recovered by *Siene* during the process, however, most of the original cable appears to have been left on the seabed.[41]

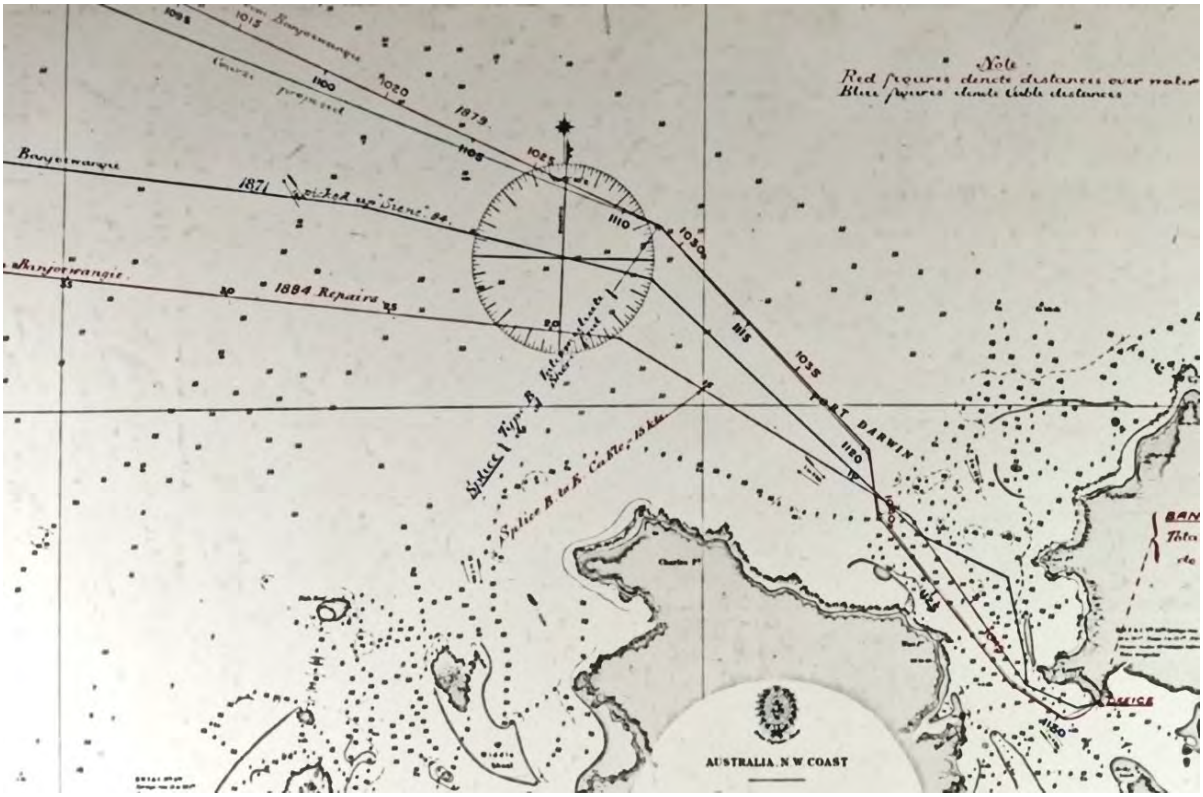

Figure 4: 1870 map of Port Darwin with annotations showing proposed and actual routes of 1871, 1879, and 1884 subsea telegraph cables.[42]

[40] Anon. 13 September 1879. "The New Cable." *The Week.* p. 11.; NT Heritage Branch. 2019.
[41] **Anon. 5 January 1884.** "The Port Darwin Cable." *The Telegraph.* p. 5.; **NT Heritage Branch. 2019.**
[42] **Stokes, J. L., E. Weller, & J. C. Wickham. 1870.** *Port Darwin and Adjacent Inlets.* Great Britain Hydrographic Department – annotated with proposed and actual routes of the Darwin-Java subsea telegraph cables 1871, 1879, and 1884. PK Porthcurno Museum of Global Communications, Cornwall, UK. Item CH3.4 Map 13. Reproduced in **NT Heritage Branch 2019**.

Figure 5: Telegraph cable fleet in Port Darwin, 1871.[43]

Figure 6: Landing the telegraph cable, Darwin, 1871.[44]

4.2.5 *Late 19th - early 20th century development*

Throughout the 1870s, Palmerston developed from a telegraph constructor's camp to a small township and the landing at Fort Point served as the focus of trade and transport to supply the new settlement. Early growth was spurred by the discovery of gold near Pine Creek (225 km south of Darwin) in 1871 during the construction of the overland telegraph, sparking a gold rush in surrounding areas that attracted thousands of prospectors and pioneers to the NT. Development was further facilitated throughout the 1880s by the establishment of a railway line between Palmerston and the Pine Creek goldfields, and the construction of a railway jetty at Stokes Hill. The population continued to expand and regional industries, including tin mining, cattle rearing, coastal fishing, and pearling, began to emerge – the latter attracting fleets from Japan, Timor, Malaysia, and the Philippines.[45]

Port Darwin was described during this period as one of the safest and best in the world; with a wide entrance and large port doubly sheltered by the outer headlands of East Point and West Point and the inner headlands of Point Emery and Talc Head. Shipping was centred around the port facilities at Fort Hill and Stokes Hill – see Figure 7. The maritime economy during this period was dominated by coastal sailing vessels and steam ships, with a wide range of smaller craft used in the fishing and pearling industry, regional trade and transport, and recreational vessels (see Figure 8 and Figure 9).

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[43] **Sweet, S. W. 1871.** "Palmerston. Cable fleet in the harbour below Fort Hill: Gulnare, Bengal, Hibernia, Investigator, Edinburgh." State Library of South Australia, Image No. B 9745.
[44] **Anon. 1871.** "Port Darwin - landing the cable ashore - 7 November 1871." National Archives of Australia, Image No. 32018586.
[45] **Cross, J. 2011; Wade-Marshall, D. 1988.** *The Northern Territory: settlement history, administration and infrastructure.* Strategic and Defence Studies Centre, Australian National University, Canberra.

Figure 7: 1886 chart of Port Darwin, showing port facilities at Fort Hill and Stokes Hill.[46]

Figure 8: Pearling fleet of luggers and mothership at Port Darwin, 1895.[47]

[46] **Comm'r R. F. Hoskyn RN, Great Britain Hydrographic Department 1886** *Australia – North Coast Port Darwin.* State Library of Victoria, Map 50901638.
[47] **Anon 1895.** "Pearl shelling fleet at Palmerston." State Library of South Australia, Image No. B2418.

Figure 9: steam ships and sailing vessels moored alongside the Port Darwin railway jetty, 1892.[48]

A number of vessels were wrecked in Darwin Harbour in the late 19th century to early 20th century – most consisting of small to moderate timber sailing vessels and composite steam and sail vessels lost in sudden squalls and strong monsoons during the tropical wet season. A single event of devastating loss occurred in January 1897, when Port Darwin was hit with one of the worst cyclones ever recorded at the time. Palmerston township was torn apart with almost every building destroyed or severely damaged, and at least thirteen people killed. The cyclone also wreaked havoc in the harbour, coinciding with high tide and causing massive storm surges. Vessels of all types were wrecked or blown ashore and a further fifteen people were killed. Eighteen pearling luggers, three steam launches, a cutter, and three sampans are amongst the vessels recorded as lost. Many of these vessels were swept off their moorings in Port Darwin and found driven into mangroves at the mouths of East Arm and Middle Arm; several were never recovered.[49]

In 1911, a decade after Australian Federation, the NT was separated from SA and transferred to Commonwealth control as a result of the *Northern Territory Surrender Act 1908* in South Australia and the Federal *Northern Territory Acceptance Act 1910.* The township of Palmerston was subsequently officially renamed "Darwin." Around this time, the importance of Port Darwin as a potentially valuable naval strategic position began to be realised; although there were no immediate plans to establish military facilities due to the still relatively small size and isolation of the Darwin settlement. A 1911 Royal Navy recommendations report stated that once the north to south transcontinental railway line was completed, Port Darwin should be developed into a Naval Fleet secondary base, complete with reserves of coal, oil and naval stores and provisions, and docks capable of receiving the largest ships and machine shops adequate for carrying out repairs to warships. Such plans were put into abeyance following the advent of World War I, during which Darwin was only periodically used as an anchorage and coaling station.[50]

Middle Arm and Middle Point, far removed from the centre of the Palmerston settlement and Port Darwin facilities, saw little use during the late 19th and early 20th centuries. In 1884, Channel Island in Middle Arm was declared by the Government as a site for a quarantine

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[48] **Edwardes, A. D. 1892.** "Shipping in Port Darwin in 1892 with the ships 'Falkland Hill', 'S.S. Tsinan', 'Menmuir' and 'Catterthun.'" State Library of South Australia, Image No PRG 1373/34/49.
[49] **Anon 16 January 1897.** "The Port Darwin Cyclone. Details of the Damage." *The South Australian Register.*; **Anon 5 February 1897.** "Terrible Hurricane at Port Darwin." *The Northern Territory Times and Gazette.;* **Murphy, K. 1984.** *Big Blow Up North (A History of Tropical Cyclones in Australia's Northern Territory).* University Planning Authority, Darwin, NT.
[50] **Dermoudy, P. & P. Cook. 1991.** *East Point. A History of the Military Precinct, East Point, Darwin.* National Trust of Australia and Royal Australian Artillery Association of the Northern Territory, NT.; **Admiral Sir Henderson, R. 1911** "The Naval Forces of the Commonwealth – Recommendations." Reproduced in *The Time Documentary History of the War.* (1917) The Times Publishing Company, London.

station – see Figure 10. No permanent structures were established on the island until the early 1900s, however, and throughout the late 19th century most quarantine patients were held onboard quarantine hulks moored in an anchorage set up around Channel Island. One of these hulks, schooner rigged steamship *Ellengowan,* sank at its moorings in 1888, and the wreck – situated to the south of the current study area – is the oldest known shipwreck in Darwin Harbour.[51]

In 1889, a small spit of land extending from the tip of Middle Point was proclaimed as a leper station – see Figure 10. The station, known as Mud Island Lazaret – or colloquially as Living Hell Lazaret due to the exceedingly poor living conditions – was in operation from the 1880s through to the early 1930s. The lazaret consisted of a single galvanised iron building and treatment consisted of weekly visit from a health officer who travelled by vessel to Mud Island.[52] In 1931, the quarantine station at Channel Island was converted into a leprosarium and Mud Island Lazaret was permanently closed. Several new accommodation buildings, and medical clinic, and associated facilities were constructed at Channel Island, and a twice-weekly supply service via launch from Darwin was established. The Channel Island Leprosarium remained in operation until 1955, when a new leprosarium was established at East Arm.[53]

Figure 10: 1929 chart of Port Darwin, showing location of Mud Island lazaret and Channel Island quarantine station / later leprosarium near East Arm (shown by red circles).[54]

[51] **Anon. 11 February 1886.** "Quarantine at Port Darwin." *South Australian Register.* p. 3.; **Jung, S. 2008.** "Ellengowan 1866-1888: a 19th century transitional iron steamship sunk at Middle Arm." in Clark, P. (ed.) *Ten Shipwrecks of the Northern Territory.* Museum and Art Gallery of the Northern Territory, Darwin, NT.; **Kettle, E. 1991.** *Health Services in the Northern Territory – A History 1824-1970.* Australian National University, Darwin, NT.

[52] **George, G. & K. George. 2014.** "Mud Island Lazaret (1889-1931)" https://www.findandconnect.gov.au/ref/nt/biogs/YE00283b.htm; **Kettle, E. 1991.**

[53] **George, G. & K. George. 2011.** "Channel Island Leprosarium (1931-1955)" https://www.findandconnect.gov.au/ref/nt/biogs/YE00047b.htm#related; **Kettle, E. 1991.**

[54] **Great Britain Hydrographic Department. 1929.** *Australia - North coast, Port Darwin from a survey by Lieut-Comm'r. Harry T. Bennett, D. S. O., R. N. and the officers of H. M. Australian surveying ship "Geranium" 1925, with additions from a survey by Comm'r. R.F. Hoskyn, R. N., and the officers of H. M. S. "Myrmidon" 1885.* National Library of Australia, MAP RM 3394.

4.2.6 *World War II*

In the aftermath of World War I, and particularly following the demise of the Anglo-Japanese Alliance in 1921, the British Empire began to evolve a series of war plans crafted for various predicted contingencies. A British Imperial Conference in 1923 led to the development of the Royal Navy "Singapore Strategy," which made Singapore the pivot of British defence against potential aggression from the Empire of Japan. Under this strategy, Darwin was seen as the southern end of the Singapore-Australia defence line. Following subsequent recommendations made by the Royal Australian Navy, plans were put in place to develop Port Darwin as a naval refuelling depot and support base. Throughout the 1920s to early 1930s, naval fuel tanks were constructed at Stokes Hill and development of a coastal defence battery commenced at East Point. By the mid-1930s, a worsening international situation, particularly in Europe and Japan, led to further increases in Port Darwin's defences and the establishment of a Royal Australian Air Force (RAAF) base, an Australian Army barracks, and Royal Australian Navy (RAN) depot. Naval infrastructure within was further expanded, including the construction of additional naval fuel tanks at Stokes Hill, a battery at Emery Point, and establishment of additional shipping, mooring and maintenance facilities.[55]

In 1938, following harbour defence advice from the British Admiralty, plans were drawn up by the RAN to construct an anti-submarine boom net across the entrance to Port Darwin between East Point and Dudley Point (see Figure 11), along with anti-submarine indicator loop installations that would operate in conjunction with the coastal defence batteries. The Australian Naval Board initiated the construction of two boom working vessels required to lay the boom net, and the establishment of a boom depot yard at Fort Hill to manufacture and assemble components for the boom net and indicator loop systems. The boom net was designed by the British Admiralty and consisted of high tensile wire rope mesh floating nets supported by a series of trots consisting of cylindrical buoys that were anchored to the seabed via concrete mooring clumps. A gate was set into the middle of the net that could be opened to allow passage of friendly vessels. The indicator loops – designed to provide magnetic sensing of enemy vessels whereby an induced current was passed through each loop that triggered a signal when a ship or submarine passed overhead – were formed of steel and copper cable linked to an onshore indicator loop hut erected at Dudley Point.

In late 1940, transit markers for the anti-submarine boom net were erected at Dudley Point and West Point, and marker buoys, moorings for boom gate vessels and net trot moorings began to be laid out, and two indicator loops were laid to the seaward side of the net. The construction of the net was initially scheduled to be completed by the end of 1940. However, due to delays in the assembly of the net and difficulties in laying the moorings due to strong tides, the net was not fully installed until late 1942.[56]

In September 1940, Japan entered the World War II "Axis" military alliance with Germany and Italy, and in late 1941, launched direct attacks on British holdings in Malaya, Singapore and Hong Kong and the United States military base at Pearl Harbour, Hawaii. These actions led Britain, America, and Australia to formally declare war on Japan, initiating the Asia-Pacific War. Over the following few months, Darwin underwent a significant metamorphosis.

Organised evacuation programs of women and children from Darwin and surrounding areas quickly commenced under the orders of the Commonwealth War Cabinet and the township rapidly emptied of civilians. Australian and Allied forces were sent to defend Australia's northern coastline and by early 1942, almost 15,000 troops were stationed in Darwin. Port

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[55] **Dennis, P. 2010.** "Australia and the Singapore Strategy". in Farrell, .B P. & S. Hunter (eds.) *A Great Betrayal?: The Fall of Singapore Revisited*. Marshall Cavendish Edition, Singapore. pp. 20–31.; **Lockwood, D. 2005.** *Australia Under Attack; The Bombing of Darwin – 1942.* New Holland Publishers (Australia) Pty Ltd.; **Rayner, R. J. 2001.** *Darwin and the Northern Territory Force.* Rudder Press, NSW.

[56] **Forster, P. 2007.** *Fixed Naval Defences in Darwin Harbour 1939-1945; how the Navy secured Darwin Harbour against submarine attacks between 1939 and 1945.* Museum & Art Gallery of the N.T. Darwin.; **Walding, R. 2006.** *Indicator Loops, Royal Australian Navy Harbour Defences – Darwin.*

Darwin became an important staging point for Allied naval shipping and aircraft engaged in battles throughout Southeast Asia and Netherlands East-Indies.

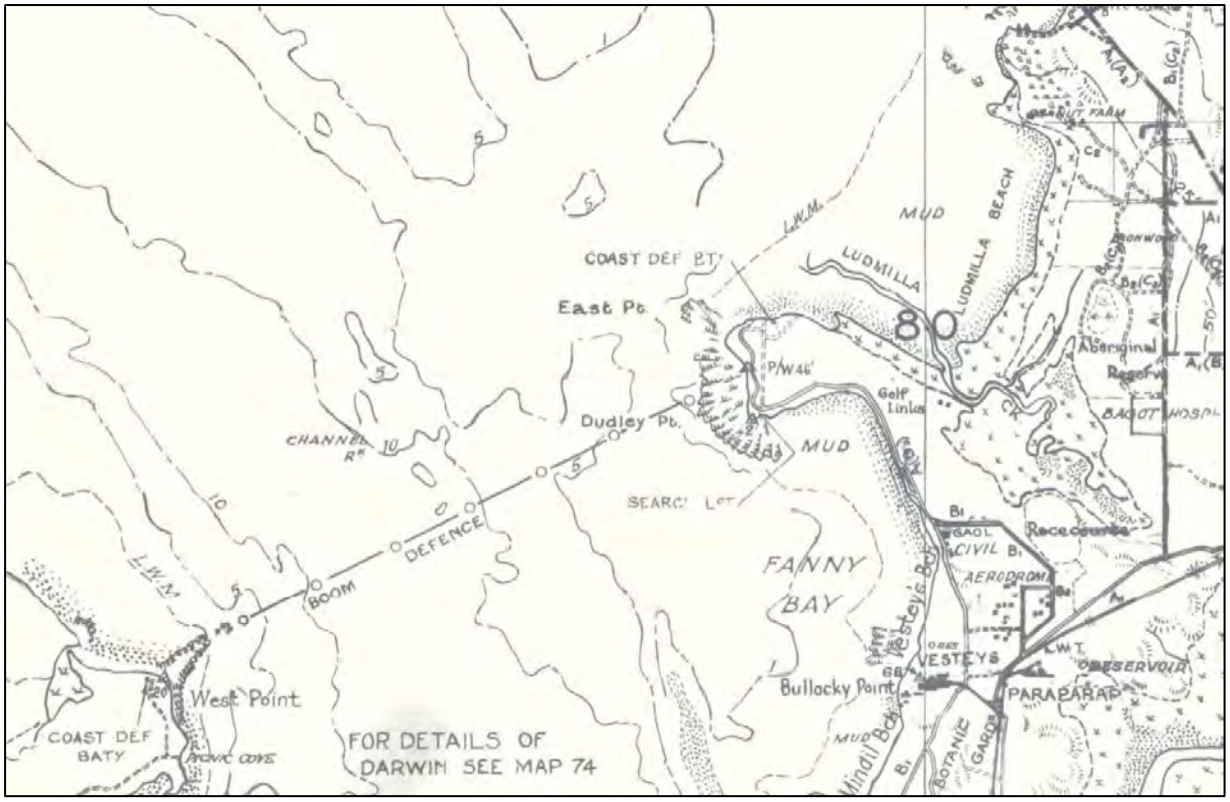

Figure 11: 1941-1945 plan of Darwin showing alignment of anti-submarine boom net.[57]

Figure 12: Boom vessel working on the Darwin anti-submarine boom net – showing detail of the net and buoys.[58]

Figure 13: Darwin anti-submarine boom net – showing gates opening to allow the passage of a ship.[59]

On 19 February 1942, Japan mounted a two-wave air raid on Darwin, marking the first attacks on the Australian mainland in World War II. The first raid consisted of a carrier-based

[57] **Australia. Army. Australian Survey Corps. 1941-1945** *Darwin and environs.* National Library of Australia, Map G9040 194-.
[58] **Turner, H.** 1943. "The Royal Australian Navy on boom defence duty at Darwin Harbour." Australian War Memorial, Image No. 014523.
[59] **McInnes, G.** 1943. "Darwin, NT. 1943-07-06. Boom gates open to allow the passage of a ship. Australian War Memorial, Image No. 053443.

aerial strike force of 188 bomber and fighter aircraft launched from a Japanese Imperial Navy fleet stationed approximately 350 km north-west of Darwin in the Timor Sea. The second raid comprised fifty-four land-based aircraft launched from the newly acquired Imperial Japanese Navy bases and Kendari and Laha, Ambon, Netherlands East-Indies. The raids attacked port facilities and shipping in Darwin Harbour, Darwin township, military installations, and aerodromes. The two raids killed at least 243 people and 300-400 were wounded. Eight Allied military vessels were sunk in the harbour – including United States Army Transport (USAT) *Mauna Loa*, USAT *Meigs*, and United States Navy destroyer USS *Peary*, situated within the current study area. Twenty-seven Allied military aircraft were also destroyed, and most civil and military facilities in Darwin suffered extensive damage. This raid was the first of many; during the course of World War II, Darwin and surrounds endured a total of sixty-four airborne Japanese attacks and several attempted submarine attacks. [60]

Following a Commission of Inquiry into the events of 19 February 1942 held by Commissioner Sir Charles John Lowe that concluded Darwin could not be defended without substantial reinforcements, the Commonwealth Government decided to place Darwin and the portion of the NT north of Alice Springs, under direct military administration. Extensive military re-organisation took place and substantial strengthening of military units and construction of new military bases occurred around Darwin Harbour.[61]

Extensions and improvements to the anti-submarine boom net and indicator loop system were conducted throughout 1942. By this time, it had been ascertained that the high variation and strength of the tides in Darwin was causing unforeseen problems in the maintenance of the boom net, and the current alignment left a strip of unprotected water at both ends of the net during high tide that would be deep enough to allow enemy vessels to pass around the boom and gain entrance to the harbour. A series of pylons were subsequently erected across the shallow and reefs at Dudley Point and West Point, connecting the boom directly to land (see Figure 15 and Figure 16). It had also been determined that the two indicator loops installed seaward of the boom net were giving frequent cable faults due to the rough seabed on which they were laid and the force of the changing tides. Following seabed surveys conducted by the Royal Australian Navy, a decision was made to replace these loops with a set of five positioned approximately 3 nm further north, between Midway on the western side of the entrance and Nightcliff on the East, and to move the Indicator Loop Control Station from East Point to Nightcliff. Works on these modifications to both the boom net and the indicator loops commenced in mid to late 1942, however, would not be completed for almost two years.[62]

An expansion of coastal defences around Darwin Harbour in 1943 saw the construction of several military facilities at Middle Point. In early 1943, an anti-aircraft search light station was established at the northern tip of Middle Point. In mid-1943, construction of a heavy anti-aircraft gun station and a satellite training camp for the Lugger Maintenance Section of the Allied Intelligence Bureau Services Reconnaissance Department commenced at Peak Hill on Middle Point. The Lugger Maintenance Section, established at East Arm in 1942, was an advance base for covert espionage, intelligence gathering, and raiding operations against Japanese forces throughout Indonesia, Timor, and the Philippines. By mid-1944, both the anti-aircraft gun station and Services Reconnaissance Department training camp were established and operational.[63]

[60] **Alford, B. 2017.** *Darwin 1942. The Japanese Attack on Australia. Campaign 304.* Osprey Publishing Ltd., Oxford, UK.; **Lockwood, D. 2005.** *Australia Under Attack: The Bombing of Darwin – 1942.* New Holland Publishers, Sydney, NSW.
[61] Ibid.
[62] *Op. Cit.* **Forster, P. 2007**; Walding, R. 2006.
[63] *Op. Cit.* **Rayner, R. J. 2001**.

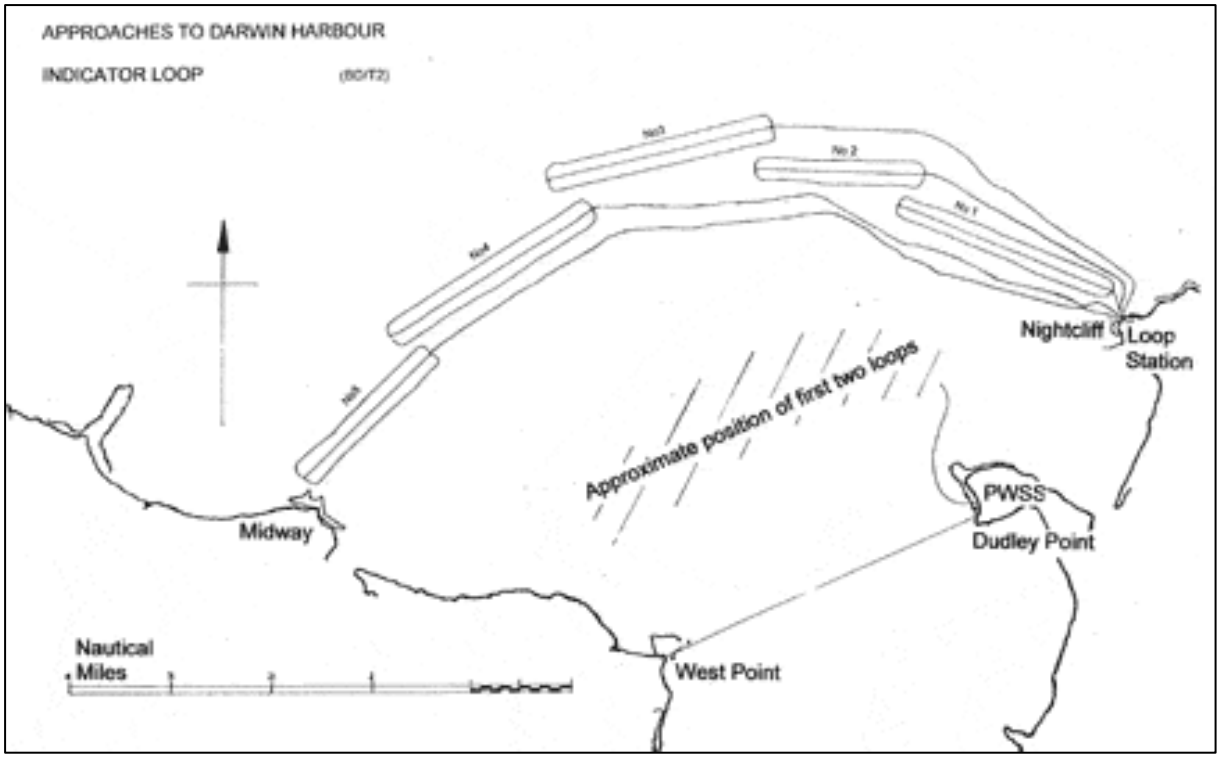

Figure 14: Sketch map showing position of anti-submarine boom net and indicator loops, Darwin Harbour.[64]

Figure 15: Anti-submarine boom net pylon, East Point.[65]

Figure 16: Anti-submarine boom net pylons, West Point.[66]

[64] *Op. Cit.* **Forster, P. 2007.**
[65] **Anon 1946** "Darwin, NT. 1946-03-05. East Point, Darwin, on which are situated the main part of Darwin's coastal defences." Australian War Memorial, Image No. 126154.
[66] **Woodrow, B. 1944** "Pylons for defence boom net, West Point." Northern Territory Library, Image No. PH0168/0082.

Figure 17: Middle Point anti-aircraft gun emplacement.[67]

From mid-1944, the Australian military was largely relegated to subsidiary fronts and the NT force was reduced in strength. However, work on some of Darwin's defence installations, including the extensions to the anti-submarine boom net and laying of the second set of indicator loops, continued throughout late 1944. These installations were finally fully operational in December 1944 – just over eight months before Allied victory and the end of World War II in 1945.[68]

4.2.7 *Post war*

After the end of World War II, control of the NT was handed back to the Commonwealth and the military units stationed in Darwin began to be demobilised and disbanded. By the late 1940s to early 1950s, most military structures and facilities were either removed or converted to civilian use. The NT economy shifted back towards pastoral, fishing, and mining industries. By the early 1960s, the Darwin population had increased over five-fold and commercial expansion and development had led to a significant increase in exports and shipping in the harbour.

The most significant event in the history of post-war Darwin was the destruction of the town by Cyclone Tracy on Christmas morning, 1974. Cyclone Tracy was the most compact cyclone on record in the Australian basin, with winds officially recorded at 217km per hour prior to the Bureau of Meteorology anemometer being destroyed. Waves in Darwin Harbour reached up to 4.5m in height. Seventy-one people were killed during the cyclone, including sixteen lost at sea. More than 70% of Darwin buildings were destroyed, all public services, including communications, power and water, were severed and the overall damage caused has been estimated at $837 million (1974 value). At least twenty-six vessels in Darwin Harbour, including a RAN patrol boat, a pilot boat, a fuel tanker, several prawn trawlers, traders, work boats, and passenger vessels, were wrecked or lost without a trace. A further twenty-one vessels were damaged.[69] Three of the known Cyclone Tracy wrecks – the Northern Research prawner *NR Diemen*, and passenger ferries *Darwin Princess* and *Mandorah Queen* – are situated within the current study area.

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[67] **Anon. 1945.** "Middle Point, Darwin, NT. 1945-04-14. Officers from 134 Anti-Aircraft Battery, 54 Anti-Aircraft Regiment inspect the gun positions after a king tide of 27 feet had lapped its base." Australian War Memorial, Image No. 088694.
[68] *Op. Cit.* **Forster, P. 2007**; Walding, R. 2006.

[69] **Attorney-General's Department Disasters Database. 2021.** "Cyclone Tracy." Australian Emergency Management Institute. http://www.emknowledge.gov.au/disaster-information; **Murphy, K. 1984.** *Big Blow Up North (A History of Tropical Cyclones in Australia's Northern Territory).* University Planning Authority, Darwin, NT.

4.2.8 *Summary of cultural activities within the study area*

From the review of the known history of the study area the following activities can be identified:

- Larrakia and Tiwi people maritime travel and subsistence activities – although these activities would likely be concentrated closer to coastal environments;
- Macassan trepang fishing and trade throughout the 18th to early 20th centuries;
- British exploration and surveying in early 19th century;
- A wide range of colonial shipping including Government and commercial cargo and passenger transport, fishing and pearling industry trade and transport, and recreational shipping, from the establishment of colonial settlement in Darwin in 1860s to present;
- Laying of subsea telegraph cables (x 3) in 1870s and 1880s;
- Quarantine and leper station transport and service supply in Middle Arm throughout late 19th to early 20th century;
- Military shipping – transport and mooring – throughout World War II;
- Air and sea combat between Allied and Japanese forces during World War II;
- Installation of anti-submarine boom net and indicator loops during World War II;
- A wide range of post war commercial, industrial, and recreational shipping activities.

4.3 Known Maritime Archaeological Sites in the Study Area

4.3.1 *Shipwrecks*

There are seventeen known shipwrecks located within the study area – refer to Table 2 and Figure 18 to Figure 20.

Four of these shipwrecks are military vessels sunk during battle in World War II, including three Allied vessels lost during the first Japanese air raid on Darwin on 19 February 1942 – United States Army transport vessels USAT *Mauna Loa* and USAT *Meigs*, and United States Navy destroyer USS *Peary*, and an Imperial Japanese Navy submarine *I-124* sunk by Allied forces on 20 January 1942. All of these shipwrecks are protected under the *Underwater Cultural Heritage* (UCH) *Act 2018*, and USAT *Mauna Loa*, USAT *Meigs*, and USS *Peary* are also protected under the NT *Heritage Act 2011.*

Three shipwrecks within the study area were lost in Cyclone Tracy, 25 December 1975, including passenger ferries *Darwin Princess* and *Mandorah Queen*, and a Northern Research prawn trawler *NR Diemen.*

Five vessels were intentionally scuttled in the 1970s and 1980s, including Taiwanese fishing vessel *Yu Han 22*, Thai fishing vessel *Medkhanun 3*, Vietnamese refugee vessels *Ham Luong* and *Song Saigon*, and workboat *John Holland Barge.*

The remaining five shipwrecks include a World War II LVT Buffalo amphibious tracked landing craft sunk in the 1960s, and three unidentified wrecks including three timber hulled vessels, and a steel barge.

Table 2: Known shipwrecks within the study area. Shipwrecks with names highlighted in gold located within proposed anchoring corridor.[70]

Name	Type	Year lost	Wreck event	Location (WGS84)	Approx. distance from proposed GEP	Statutory heritage protection
Barge - Unknown No. 1	Steel barge; likely WWII era	Not known	Not known	-12.44830° 130.81038°	1700 m	N/A
Buffalo Amphibian	Steel LVT Buffalo amphibious tracked landing craft – 16.5 tons, 7.95 m in length	1960s	Foundered whilst being used as support vessel for Mandorah Ferry	-12.41033° 130.80294°	1380 m	N/A
Darwin Harbour Unidentified Wreck 2	Timber hulled vessel – 30 m in length, carrying 10 tons of steel cargo	Not known	Not known	-12.48333° 130.83333°	2000 m	N/A
Darwin Princess	Steel motor vessel passenger ferry – 22.8 m in length	1974	Wrecked in Cyclone Tracy	-12.39815° 130.76535°	1300 m	N/A
NR Diemen	Motor vessel prawn trawler – 124 tons, 20.4 m in length	1974	Wrecked in Cyclone Tracy	-12.42660° 130.76528°	700 m	N/A
Ham Luong	Steel Vietnamese refugee motor vessel – 15 m in length	1983	Scuttled to form an artificial reef	-12.47509° 130.80067°	1140 m	N/A
John Holland Barge	Steel work barge – 18 m long by 12 m wide	1982	Scuttled to form an artificial reef	-12.47386° 130.80139°	930 m	N/A
Medkhanun 3	Steel Thai fishing motor vessel – 25 m in length	2007	Scuttled to form an artificial reef	-12.47870° 130.80236°	850 m	N/A
Mandorah Queen	Steel and aluminium motor vessel passenger ferry – 22 m in length	1974	Wrecked in Cyclone Tracy	-12.442722° 130.778306°	690 m	N/A
Mandorah Unidentified Wreck 1	Timber hull motor vessel	Not known	Not known	-12.446660° 130.766950°	2000 m	N/A
Mandorah Unidentified Wreck 2	Timber hull motor vessel	Not known	Not known	-12.448100° 130.766100°	2000 m	N/A
Song Saigon	Steel Vietnamese refugee motor vessel – 200 tons, 38 m in length	1982	Scuttled to form an artificial reef	-12.474722° 130.801278°	755 m	N/A
USAT *Mauna Loa*	Steel single screw steamship, former passenger cargo vessel commissioned as a United States Army transport during World War II. 5436 tons, 125 m in length	1942	Sunk by enemy action during first Japanese air raid on Darwin Harbour on 19 February 1942	-12.49704° 130.81936°	15 m*	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)
USAT *Meigs*	Steel single screw steamship, former cargo vessel commissioned as a United States Army transport during World War II. 12568 tons, 131.3 m in length	1942	Sunk by enemy action during first Japanese air raid on Darwin Harbour on 19 February 1942	-12.48765° 130.81838°	270 m*	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)

[70] All data obtained from the Australian Underwater Cultural Heritage Database (AUCHD)

Name	Type	Year lost	Wreck event	Location (WGS84)	Approx. distance from proposed GEP	Statutory heritage protection
USS *Peary*	Steel twin screw steamship, United States Navy Clemson Class destroyer – 1190 tons, 95.8 m in length	1942	Sunk by enemy action during first Japanese air raid on Darwin Harbour on 19 February 1942	-12.47533° 130.82982°	2000 m*	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)
Yu Han 22	Timber Taiwanese fishing motor vessel – 25 m in length	1975	Partially burned and scuttled	-12.5175° 130.82166°	730 m	N/A
I-124	Steel Imperial Japanese Navy I-121 Class minelaying submarine – 1470 tons, 85.2 m in length	1942	Sunk during counterattack by Allied forces on 20 January 1942.	-12.120091° 130.106561°	100 m*	*UCH Act 2018* – 800 m radius (under *UCH Act 2018*)
**Note – distances with asterisk are measured from closest boundary of heritage protection zone to GEP route. Locations highlighted in yellow have been determined by examination of MBES data and differ from locations provided on AUCHD.*						

Figure 18: Location of known shipwrecks in study area – Darwin Harbour.

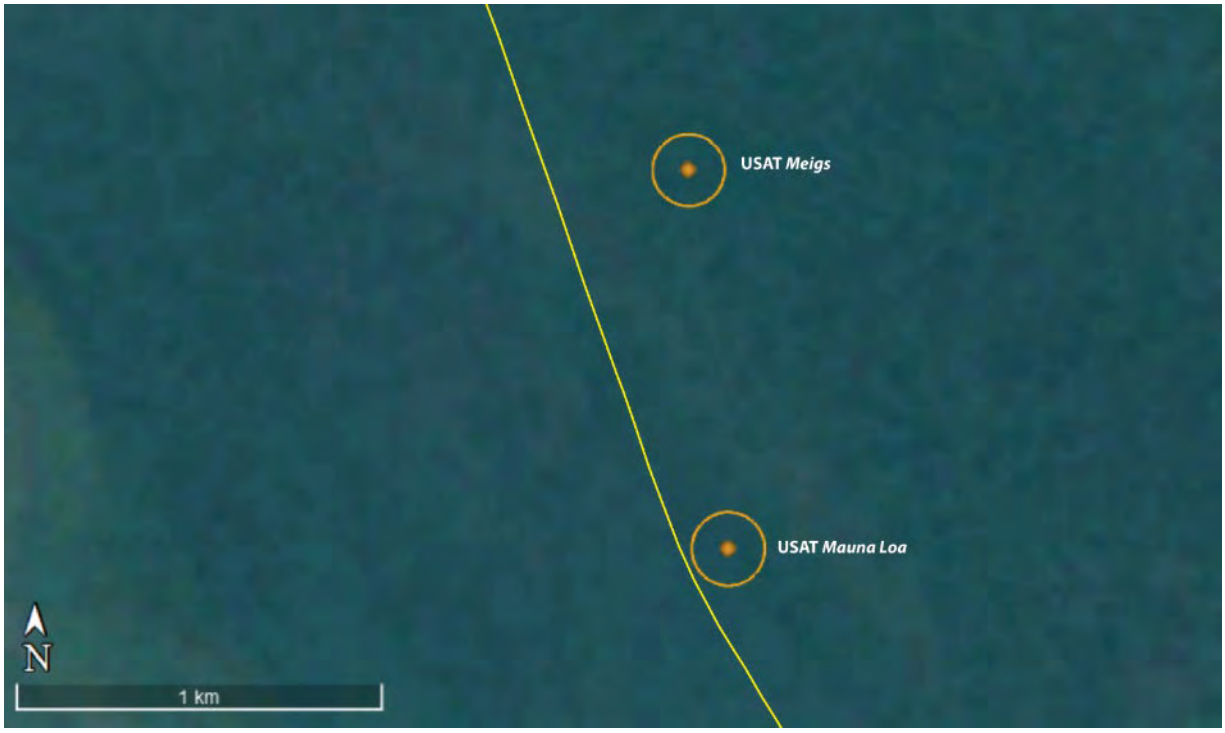

Figure 19: Detail of proximity of USAT Mauna Loa and USAT Meigs to proposed GEP.

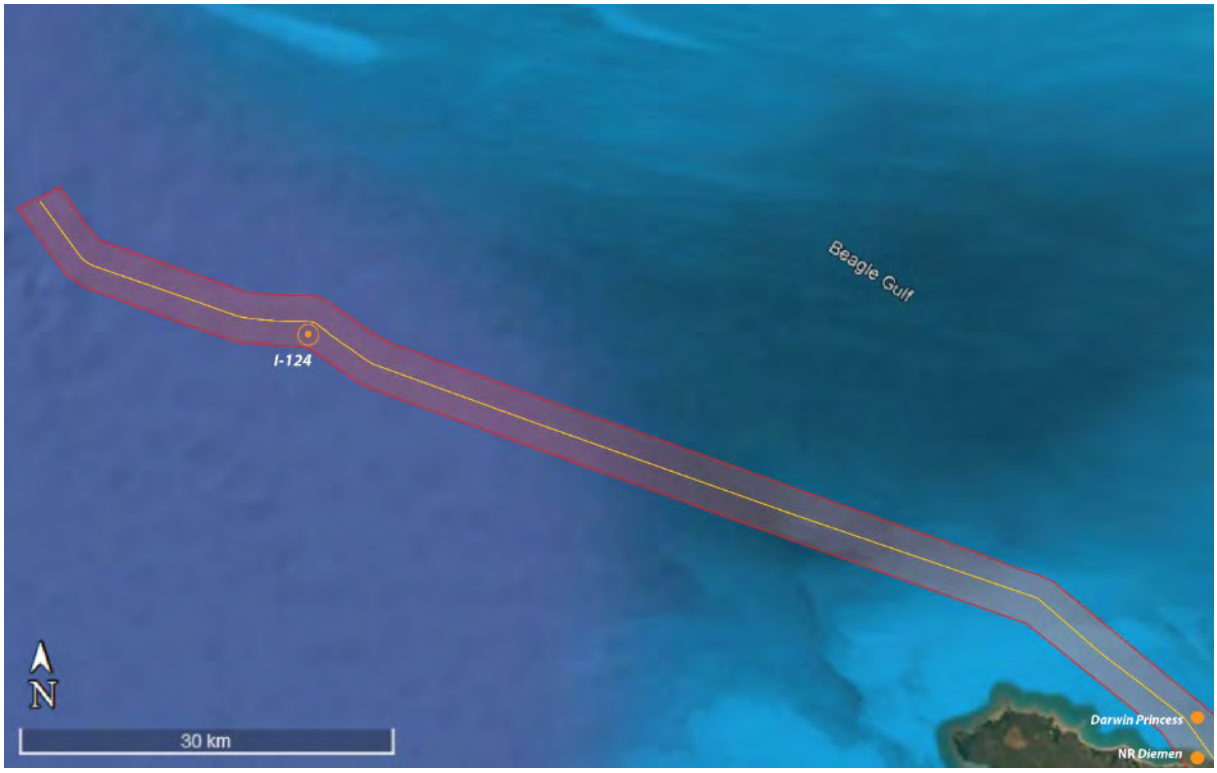

Figure 20: Location of known shipwrecks in study area – Beagle Gulf.

Figure 21: USAT Mauna Loa.[71]

Figure 22: USAT Meigs.[72]

Figure 23: Darwin Princess.[73]

Figure 24: Song Saigon being scuttled.[74]

4.3.2 *Aircraft wrecks*

There are no known aircraft wrecks located within the study area. The closest known aircraft wreck is the wreck of a Douglas C-47 Dakota, RAAF A65-115, that was forced to ditch into the harbour due to engine failure during a test flight in 1946. The wreck of the C-47 is situated in Fannie Bay, approximately 2km north-east of the study area.

4.3.3 *Maritime infrastructure*

Six historical maritime infrastructure installations are known to occur within parts of the study area, including three 19th century subsea telegraph cables, a World War II anti-submarine boom net installation, and two groups of World War II indicator loops – see Table 3, Figure 25 and Figure 26.

Table 3: Known historical maritime infrastructure within the study area.[75]

Name	Type	Year built	Statutory heritage protection
Subsea telegraph cable - original	First installation of an approximately 1,561 km long subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java, Indonesia. The cable consists of seven stranded copper wires, insulated with gutta-percha latex, sheathed in galvanised iron wire armour, and an outside covering of tarred hemp. The cable ranges in diameter from 3" at shore ends, 1" in intermediate portions, and ¾" in deep sea portions.	1871	The subsea cable landing at Darwin is protected under the NT *Heritage Act 2011*.

[71] **Frost, W. E. 1932.** "S.S. *Golden Eagle."* City of Vancouver Archives, Item AM1506-S3-2-: CVA 447-2246.
[72] **Anon. 1942.** "The United States Army Transport (USAT) Meigs underway in Darwin Harbour some days before the Japanese air raid on 19 February 1942." Australian War Memorial, Image No. P05303.019.
[73] **Anon. 1973.** "*Darwin Princess."* Library and Archives NT, Image No. PH0366/0017.
[74] **Anon. 1982.** "*Song Saigon* being scuttled." Darwin Sub-Aqua Club files; https://www.dsac.com.au/Divesite_files/Song.htm
[75] Data obtained from **Forster, P. 2007.** *Fixed Naval Defences in Darwin Harbour 1939-1945; how the Navy secured Darwin Harbour against submarine attacks between 1939 and 1945.* Museum & Art Gallery of the N.T. Darwin.; **NT Heritage Branch.**

Name	Type	Year built	Statutory heritage protection
Subsea telegraph cable - duplicate	Duplicate subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java, Indonesia. The duplicate cable was of the same composition as the original 1871 cable.	1879	The subsea cable landing at Darwin is protected under the NT *Heritage Act 2011*.
Subsea telegraph cable - replacement	Replacement subsea telegraph cable linking Darwin cable station to Banjoewangi cable station, Java, Indonesia. Cable is of similar composition to the earlier two but contained an additional layer of brass tape around the core to protect the cable from marine borer (namely *teredo navalis)* attack.	1884	The subsea cable landing at Darwin is protected under the NT *Heritage Act 2011*.
Anti-submarine boom net	A 6km-long anti-submarine boom net constructed between Dudley Point and East Point, across the entrance to Port Darwin. The boom consisted of high tensile wire rope (1-2" diameter), 8' mesh floating nets. The nets were supported by a series of trots laid out 195' (60 m) apart, each consisting of three cylindrical buoys anchored via 1 ½ - 2"chain cable to eight 5-8 ton reinforced steel concrete mooring clumps laid on the seabed – four on the seaward side of the net, four on harbour side. A total of 265 clump moorings were laid. A permanently guarded gate was set into the net within the Port Darwin shipping channel. The boom net and buoys were largely cleared at the end of World War II; however the concrete clump moorings and chains were left *in situ*. *Anti-submarine boom net mooring trots were located and identified during ROV survey. Refer to Section 7 and Annex A for details.	1940-1942	N/A
Indicator loops – original (x2)	Initial installation of two indicator loops between Dudley Point and West Point, across the entrance to Port Darwin on the seaward side of the anti-submarine boom net. The loops provided magnetic sensing of enemy vessels, whereby an induced current was passed through each loop that triggered a signal when a ship or submarine passed overhead. The loops were formed of 33 mm diameter cable consisting of a single core of tinned copper wire, insulated with India rubber, hessian tape, tarred jute yarn, steel armour wires, hot pitch and resin coating. Each loop was typically 5000 yards long by 400 yards wide, with a central cable running the length of the loop, connected to a 25 mm diameter tail cable linked to the onshore indicator loop hut. The loops were dismantled and lifted following the end of World War II, however, it is not known if all components were recovered.	1940	N/A
Indicator loops - replacement (x 5)	Following several breakages of the initial two indicator loops due to strong tides and rough seabed, a replacement set of five indicator loops was installed ca. three miles further seaward, stretching between Midway and Nightcliff. The loops were of the same design and construction as the original set. The loops were dismantled and lifted following the end of World War II, however, it is not known if all components were recovered.	1943	N/A

2019. *The Darwin Subsea Telegraph Cables – Heritage Assessment Report.*; **Walding, R. 2006.** *Indicator Loops, Royal Australian Navy Harbour Defences – Darwin.*

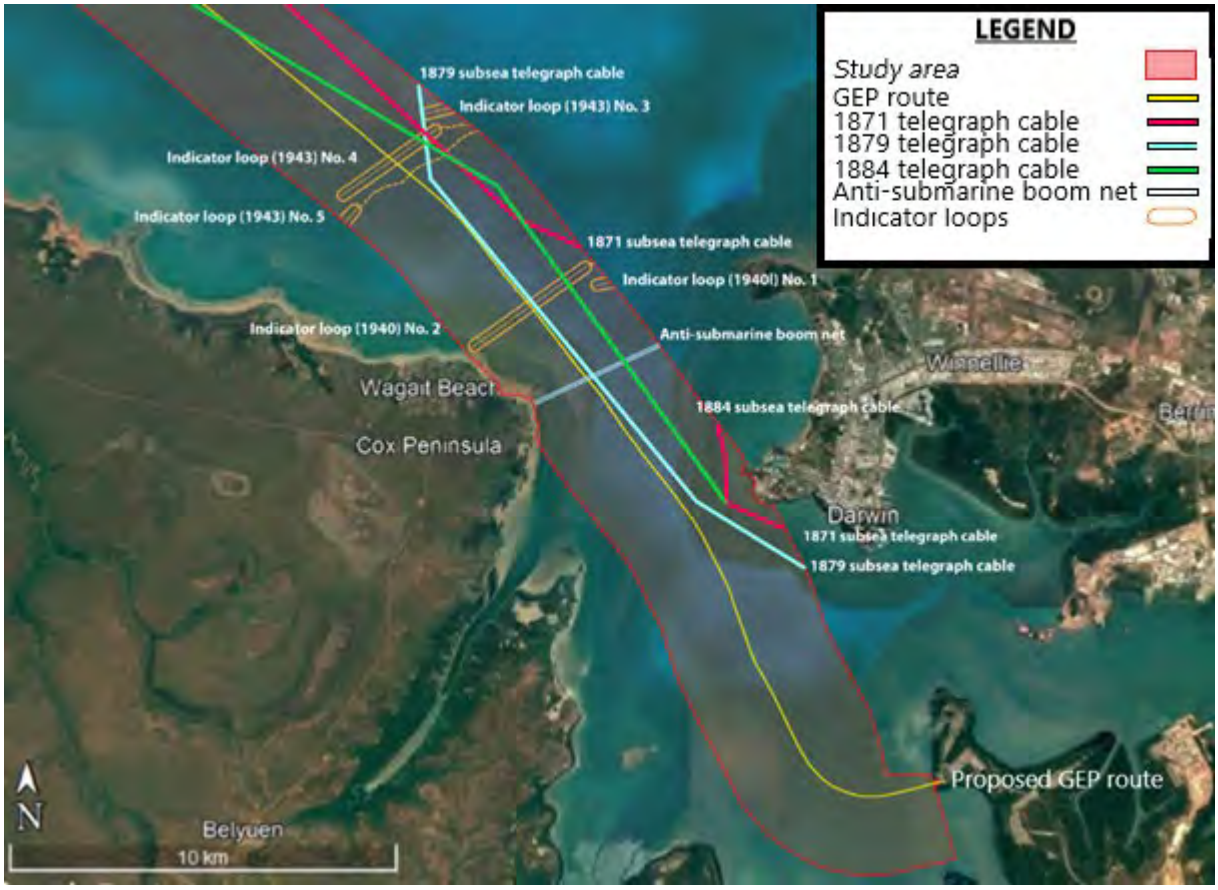

Figure 25: Location of historical maritime infrastructure in study are a (based on historical map overlays) – Darwin Harbour.

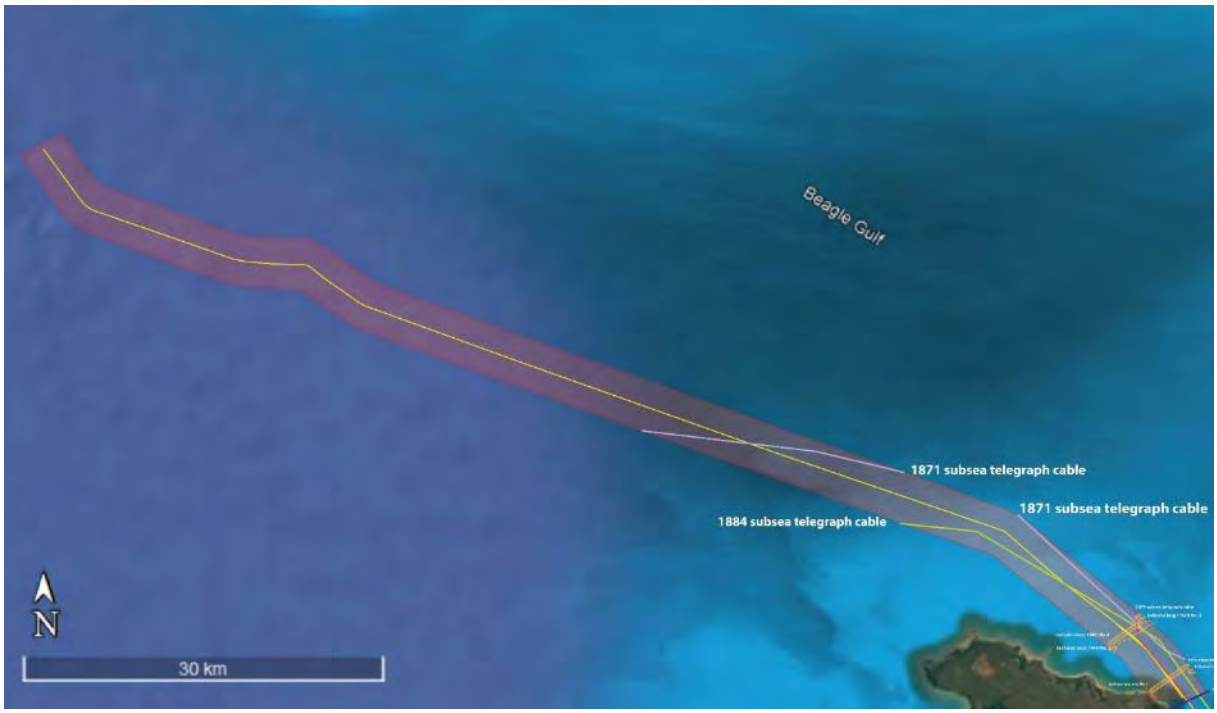

Figure 26: Location of historical maritime infrastructure in study area (based on historical map overlays) – Beagle Gulf.

Figure 27: Section of the 1871 Darwin to Java subsea telegraph cable recovered from Timor Sea in 2016.[76]

Figure 28: Surviving section of 1871 subsea telegraph cable, Darwin Harbour.[77]

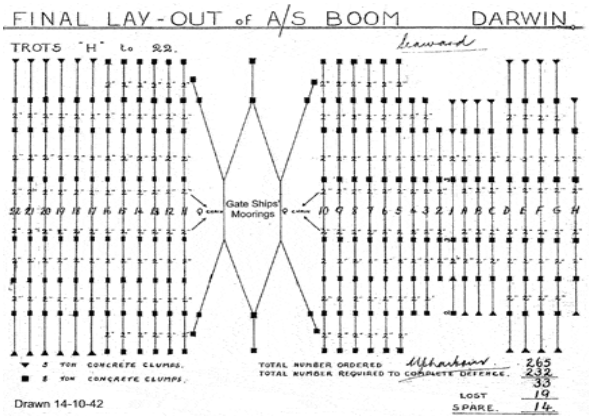

Figure 29: Layout of the Darwin anti-submarine boom net.[78]

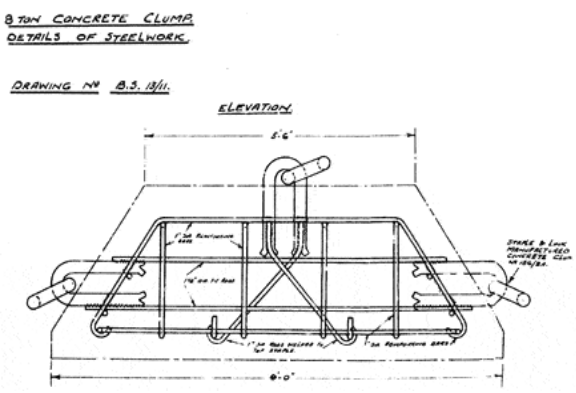

Figure 30: Construction details of the Darwin anti-submarine boom net mooring blocks.[79]

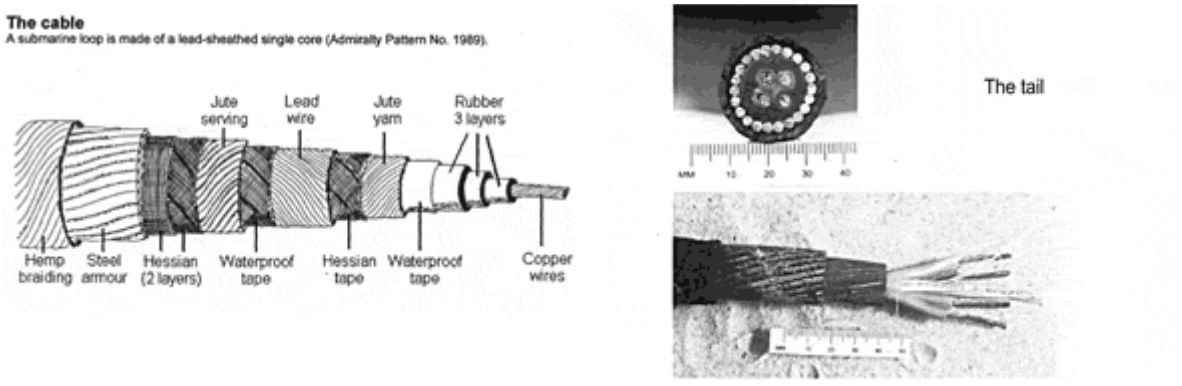

Figure 31: Construction details of the Darwin indicator loop cables.[80]

[76] **"A section of the Port Darwin to Java underwater telegraph cable, 1871-1872." Held at the National Museum of Australia.**
[77] **NT Heritage Branch. 2019.**
[78] **Forster, P. 2007.**
[79] **Forster, P. 2007.**
[80] **Forster, P. 2007.**

4.3.4 *Sea dumping*

Other than the intentional scuttling of vessels and UXO located during INPEX surveys – discussed in Section 4.3.1 and 4.3.5 respectively – no known episodes of sea dumping are located within the study area.

4.3.5 *Unexploded Ordnance*

*** This section looks at UXO only from a heritage perspective. It is not intended to provide UXO specialist advice or to constitute a detailed UXO risk assessment.*

Documented unexploded ordnance (UXO) is known to occur at four shipwrecks located within the study area – see Table 4.

In each instance, this UXO consists of munitions cargo and unfired / unexploded naval ordnance payload associated with World War II military vessels wrecked in 1942. All items of UXO associated with these four shipwrecks are protected under the *UCH Act 2018.*

***Table 4: Known UXO within the study area.*[81]**

Shipwreck	UXO type	Wreck location (WGS84)	Approx. distance to proposed GEP*	Statutory heritage protection
USAT *Mauna Loa*	.303 calibre and .45 calibre ammunition, and 3" mortars	-12.49704° 130.81936°	15 m	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)
USAT *Meigs*	.303 calibre ammunition and possible depth charges or land mines	-12.48765° 130.81838°	270 m	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)
USS *Peary*	3" and 4" artillery shells	-12.47533° 130.82982°	2000 m	*UCH Act 2018* and *NT Heritage Act 2011* – 100 m radius (under *NT Heritage Act 2011*)
I-124	5.5" artillery shells and 21" torpedoes	-12.120091° 130.106561°	100 m	*UCH Act 2018* – 800 m radius (under *UCH Act 2018*)
Contact 2	Mechanical time fuses and fuse cones	-12.416111° 130.762500°	175 m	No statutory protection, no heritage protection radius.
**Note – distances highlighted in yellow are measured from closest boundary of heritage protection zone to GEP route.*				

***Figure 32: Artillery shell within the wreck of USS Peary.*[82]**

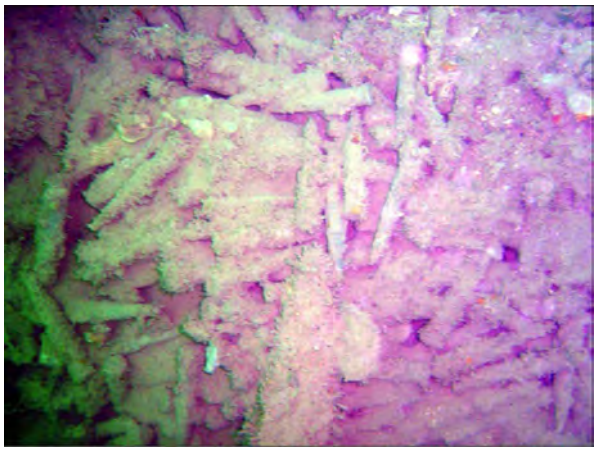

***Figure 33: Small arms ammunition inside cargo hold of USAT Mauna Loa wreck.*[83]**

[81] All data obtained from the Australian Underwater Cultural Heritage Database (AUCHD)
[82] **Steinberg, D. 2015.** The World War II Shipwrecks of Darwin Harbour; a report on the archaeological inspection and assessment of seven historic shipwrecks. NT Heritage Branch.
[83] Ibid.

Additionally, one location of dumped UXO was recorded during the INPEX GEP survey conducted by CA in 2012.[84] This consisted of a collection of dumped mechanical time fuses and fuse cones located near KP 105 at 691614 m E and 8626792 m N, approximately 175 m from the proposed GEP route (see Section 6.4.1.2, Figure 34).

Figure 34: Collection of mechanical time fuses and fuse cones located at Contact 2, on the alignment of the INPEX GEP. Contact 2 is located approximately at location of KP 105 along proposed Barossa GEP route. (Source: CA 2012).

4.4 Potential Maritime Archaeological Sites in the Study Area

4.4.1 *Shipwrecks*

There are twenty-nine known but unlocated shipwrecks in Darwin Harbour and Beagle Gulf that could potentially occur within the study area based on historical accounts of the wreck event and wreck location – see Table 5.

The majority of these shipwrecks comprise small timber-hulled sailing vessels lost during the late 19th to early 20th centuries – in many cases due to extreme weather events, such as nine pearling luggers and a Chinese junk wrecked during a major cyclone that struck Darwin in January 1897, two sailing vessels lost in strong gales during the 1880s, and a launch lost in a cyclone that hit Darwin in March 1915. The remainder includes a composite clipper ship / Royal Australian Navy (RAN) coal hulk scuttled in 1932, three workboats lost during World War II, mid-20th century wrecks of a motor launch and a barge, and a timber-hulled motor vessel sloop lost in Cyclone Tracy in December 1974.

There is also potential for shipwrecks not documented in the historical record to be located within the study area, including Aboriginal, Macassan, and early colonial watercraft.

Any shipwreck within the study area that dates prior to 1947 – whether located or not – is automatically protected under the *UCH Act 2018*.

Table 5: Potential shipwrecks within the study area. [85]

Name	Type	Year lost	Wreck event	General location
Ark	Timber pearling lugger	1897	Wrecked in 1897 cyclone	Darwin Harbour
Astraea	Timber barque	1886	Disappeared on voyage	Between Darwin and Queensland.
Bear Sing	Timber sailing vessel	1886	Wrecked in a strong gale	Darwin Harbour
Black Jack	Timber pearling lugger	1897	Wrecked in 1897 cyclone	Darwin Harbour
Charity	Timber lugger	1897	Disappeared on voyage	Between Darwin and WA

[84] *Op. Cit.* **Cosmos Archaeology, 2012**:11.
[85] All data obtained from the Australian Underwater Cultural Heritage Database (AUCHD)

Name	Type	Year lost	Wreck event	General location
Darwin Harbour Unidentified Chinese Junk 1	Timber junk	1897	Wrecked in 1897 cyclone	Darwin Harbour
Darwin Harbour Unidentified Lugger 1	Timber lugger	1939	Destroyed by fire after stove explosion	Darwin Harbour
Darwin Harbour Unidentified Lugger 2	Timber lugger	1910	Scuttled	Darwin Harbour
Dawn	Timber ketch; 51 tons	1893	Broken up	Darwin Harbour
Eileen	Timber ketch; 13 tons	1939	Foundered	Near Charles Point, Beagle Gulf
Good Intent	Timber ketch	1892	Foundered	Between Darwin and Charles Point, Darwin Harbour – Beagle Gulf
Gertrude	Timber pearling lugger	1897	Wrecked in 1897 cyclone	In shoal water on Middle Point, Darwin Harbour
Gunyana	Timber motor vessel sloop	1974	Disappeared in Cyclone Tracy	Darwin Harbour – Beagle Gulf
HMAS *Hankow*	Composite clipper ship, coal hulk, 1249 tons, 223 m in length	1932	Scuttled with demolition charges	Outside entrance to Darwin Harbour / west of East Point
Harbour Tug	Tug	1942	Foundered	Beagle Gulf – Timor Sea
Hibernia	Timber ketch, 13 tons	1882	Foundered	Darwin Harbour, within the fairway to the anchorage
Jack	Timber pearling lugger	1897	Wrecked in 1897 cyclone	Darwin Harbour
Karalee	Timber lighter, 117 tons	1943	Foundered	Darwin Harbour
Lighter No. 2	Steel lighter, 86 tons	1943	Lost by enemy action	Near Darwin
Olga	Timber motor vessel launch	1926	Sunk after onboard chemical explosion	Ca. 48 km from Darwin, towards Bathurst Island, Beagle Gulf
Olive	Timber pearling lugger	1897	Wrecked in 1897 cyclone	South-west of Fort Hill, Darwin Harbour
Peron	Motor launch	1948	Disappeared	Near Darwin; Darwin Harbour – Beagle Gulf
Pinafore	Timber sailing vessel	1881	Wrecked in a gale	Darwin Harbour, ca. 4 km out of Fannie Bay
Revenge	Timber pearling lugger	1897	Wrecked in 1897 cyclone	Darwin Harbour
Roebuck	Timber pearling lugger	1897	Wrecked in 1897 cyclone	In mangroves, one mile south of Middle Point, Darwin Harbour
Scout	Timber pearling lugger	1897	Wrecked in 1897 cyclone	On eastern side of Middle Point, Darwin Harbour
Spray	Timber launch	1915	Wrecked in 1915 cyclone	Darwin Harbour
Triumph	Steel barge	1954	Foundered	Off Darwin, Darwin Harbour - Beagle Gulf
Zulieka	Timber sailing vessel	1897	Wrecked in 1897 cyclone	On a reef off Channel Island, Middle Arm, Darwin Harbour

4.4.2 *Aircraft wrecks*

There are twenty-five known but unlocated aircraft wrecks in Darwin Harbour and Beagle Gulf that could potentially occur within the study area based on historical accounts of the wreck event and general wreck location – see Table 6.

All of these wrecks are military combat aircraft, including eleven Imperial Japanese Navy (IJN) and Navy Air Force (IJNAF) aircraft, seven United States Army Air Force (USAAF)

aircraft, six Royal Australian Air Force (RAAF) aircraft, and one Royal Air Force (RAF) aircraft. All but one of these aircraft – an RAAF fighter wrecked in 1961 – were lost during World War II.

Any of these World War II aircraft wrecks that are situated within Commonwealth waters (from waters 3 nm seaward of the territorial sea baseline) are automatically protected under the *UCH Act 2018.* All USAAF aircraft wrecks are also automatically protected under the US *Sunken Military Craft Act 2004.*

Table 6: Potential aircraft wrecks within the study area.

Aircraft type / number	Operator	Wreck event	Year Lost	General location
CAC Sabre A94-360 (military fighter); pilot Irvine	Royal Australian Air Force (RAAF) – 81 Wing	Failure of port wing caused catastrophic mid-air explosion.	1961	Darwin Harbour, near Talc Head
Curtiss P-40E Kittyhawk (military fighter); pilot Andrew	United States Army Air Force (USAAF) - 7th Squadron, 49th Pursuit Group	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1942	West of Charles Point, Beagle Gulf
Curtiss P-40E Kittyhawk (military fighter); pilot Drake	USAAF - 7th Squadron, 49th Fighter Group	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1942	Off West Point, Darwin Harbour
Curtiss P-40E Kittyhawk (military fighter); pilot Fish	USAAF - 8th Squadron, 49th Pursuit Group	Shot down by IJNAF A6M2 "Zero" fighters.	1942	Approximately 3 km S-SE of Swires Bluff, Darwin Harbour
Curtiss P-40E Kittyhawk (military fighter); pilot McComsey	USAAF - 9th Squadron, 49th Pursuit Group	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1942	Off West Arm, southern side of Darwin Harbour
Curtiss P-40E Kittyhawk (military fighter); pilot Pell	USAAF - 33rd Pursuit Squadron	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1942	Camerons Beach, Shoal Bay, Darwin Harbour
Curtiss P-40E Kittyhawk (military fighter); pilot Strauss	USAAF - 8th Squadron, 49th Pursuit Group	Shot down by IJNAF A6M2 "Zero" fighters.	1942	Approximately 2.7 km north-west of Emery Point, Fannie Bay, Darwin Harbour
Curtiss P-40E Kittyhawk (military fighter); pilot Wiecks	USAAF - 33rd Pursuit Squadron	Shot down by IJNAF A6M2 "Zero" fighters.	1942	Darwin Harbour; near harbour entrance
Kawanishi H6K4 "Mavis" (military bomber); pilot Mirau	Imperial Japanese Navy (IJN) - Toko Ku Southwest District Fleet	Shot down by USAAF 3rd Pursuit Squadron P-40 Kittyhawk.	1942	South / south-west of Melville Island, Beagle Gulf – Timor Sea
Lockheed Hudson A16-137 (ex 41-23207) (military bomber)	RAAF - No. 13 Squadron	Disappeared after departing Darwin for an attack mission on Kupang, Indonesia.	1942	Possibly Beagle Gulf - Timor Sea
Lockheed Hudson A16-170 (ex 41-23607) (military bomber)	RAAF - No. 13 Squadron	Disappeared after departing Darwin for an attack mission on Kupang, Indonesia.	1942	Possibly Beagle Gulf - Timor Sea
Mitsubishi A6M2 "Zero" (military fighter); pilot Murakami	Imperial Japanese Navy Air Force (IJNAF) - 3 Ku, 23rd Koku Sentai	Shot down by USAAF 7th Squadron, 49th Pursuit Group P-40 Kittyhawks. .	1942	ca. 32 km north-west of Darwin, Beagle Gulf
Mitsubishi A6M2 "Zero" (military fighter); pilot Tajiri (m/n 6540)	IJNAF - 202 Ku, 23rd Koku Sentai	Shot down by RAAF / RAF No. 54 Squadron Spitfire.	1943	Darwin Harbour; immediately south of West Point
Mitsubishi G4M1 "Betty" (military bomber); pilot Asahiro	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF P-40 Kittyhawks.	1942	Beagle Gulf
Mitsubishi G4M1 "Betty" (military bomber); pilot Fujiwara	IJNAF – 753 Ku, 23rd Koku Sentai	Shot down by RAAF 457 Squadron Spitfires.	1943	West / north-west of Charles Point, Cox Peninsula, Beagle Gulf
Mitsubishi G4M1 "Betty" (military bomber); pilot Inada	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group P-40 Kittyhawks and / or 14 HAA anti-aircraft battery Darwin.	1942	In sea north-west of Darwin, Beagle Gulf.

Aircraft type / number	Operator	Wreck event	Year Lost	General location
Mitsubishi G4M1 "Betty" (military bomber); pilot Kato	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group.	1942	North-west of Darwin; Beagle Gulf - Timor Sea
Mitsubishi G4M1 "Betty" (military bomber); pilot Kirino	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group.	1942	North-west of Darwin; Beagle Gulf - Timor Sea
Mitsubishi G4M1 'Betty" (military bomber); pilot Ozaki	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group.	1942	North-west of Darwin; Beagle Gulf - Timor Sea
Mitsubishi G4M1 "Betty" (military bomber); pilot Tomohara	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group.	1942	North-west of Darwin; Beagle Gulf - Timor Sea
Mitsubishi G4M1 "Betty" (military bomber); pilot Unohara	IJNAF - Takao Ku, 23rd Koku Sentai	Shot down by USAAF 49th Pursuit Group.	1942	North-west of Darwin; Beagle Gulf - Timor Sea
Supermarine Spitfire A58-6 (ex AR563) (military fighter)	RAAF - No. 452 Squadron	Engine failure during formation practice flight caused pilot to force land in intertidal mangroves.	1943	Middle Arm, Darwin Harbour
Supermarine Spitfire A58-34 (ex-BR525) (military fighter)	RAAF - No. 452 Squadron	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1943	Approximately 48 km north-west of Darwin, Beagle Gulf.
Supermarine Spitfire A58-86 (ex-BS221) (military fighter)	Royal Air Force (RAF) - No. 54 Squadron	Engine failure during flight to intercept incoming IJNAF attack forced pilot to bail out and aircraft crashed into sea.	1943	Approximately 48 km north-west of Darwin, Beagle Gulf.
Supermarine Spitfire A58-89 (ex-BS225) (military fighter)	RAAF - No. 452 Squadron	Damaged during dogfight with incoming IJNAF attack, forcing pilot to bail out and aircraft to crash into sea.	1943	North-west of Darwin, Beagle Gulf - Timor Sea

4.4.3 *Maritime infrastructure*

The study area passes through some historical anchorages within Darwin Harbour, including a late 19th to mid-20th century quarantine anchorage, and 1930s to 1940s naval anchorages. It is possible that permanent moorings were established in some areas of these anchorages, and that remnants of such moorings, most likely large clump anchors or concrete mooring blocks and associated chains, remain on the seabed.

4.4.4 *Sea dumping*

Previous maritime archaeological investigations have found substantial evidence of sea dumping of World War II era military material within Darwin Harbour: including aircraft parts, armament and ammunition, automotive parts and accessories, camp furniture and equipment, power and electrical equipment, fuel storage containers, and manual tools. Much of this material has been found in piles or clusters across the seabed, suggesting discrete dumping events from a barge or similar vessel. It was concluded that this material most likely represents post-war disposal of surplus and / or unserviceable military equipment.[86]

There is a potential for similar evidence of post-World War II sea dumping of military material to occur within the study area.

4.4.5 *UXO*

*** This section looks at UXO only from a heritage perspective. It is not intended to provide UXO specialist advice or to constitute a detailed UXO risk assessment.*

[86] **Cosmos Archaeology Pty Ltd. 2014.** INPEX Ichthys LNG Project, Nearshore Development – Dredging, East Arm, Darwin Harbour, Northern Territory – Relocation of Heritage Objects and Removal of Debris. Report prepared for Tek Ventures Pty Ltd.

There is a potential for various types of UXO – namely World War II era UXO – to occur within the study area, including:

- Crashed Allied and Japanese military aircraft ordnance payloads;
- Japanese air-delivered munitions;
- Japanese sea-delivered munitions;
- Allied artillery munitions from coastal defences and anti-aircraft bases, and;
- Sea dumping of surplus military ammunition.

The Department of Defence maintains a record of sites confirmed as, or reasonably suspected of, being affected by UXO.[87] These records show that various areas of Darwin Harbour and Beagle Gulf have historically been used for military training – see Figure 35. The study area passes through the location of a former air to air weapons range; however, Defence records do not confirm whether this area was used for live firing, and UXO or explosive ordnance fragments have not been recovered from the area.

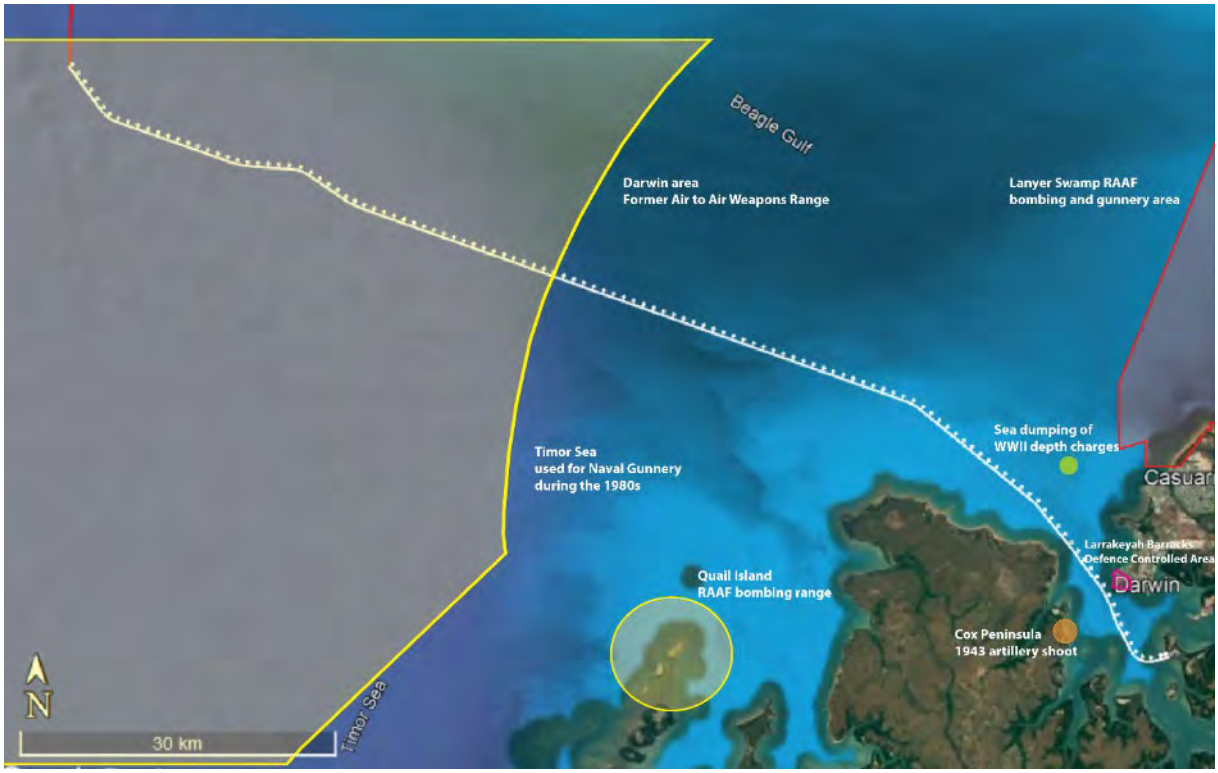

Figure 35: Areas where UXO may occur based on Department of Defence records.[88]

[87] **Australian Government Department of Defence. 2022.** Defence UXO Mapping Application. whereisuxo.org.au
[88] **Australian Government Department of Defence. 2022**.

5 PREDICTED CONDITION OF MARITIME ARCHAEOLOGICAL SITES

5.1 Introduction

The condition of any maritime archaeological resource is affected by environmental and cultural factors as well as the nature of the seabed.

With regards to the study area, the following factors will have the greatest impact on site formation processes:

- Type of event leading to presence on seabed;
- Soft marine sediments;
- Mechanical damage caused by waves;
- Salvage;
- Anchor and trawl drags;
- Chemical and biological degradation.

5.2 Site Environment

As discussed in Section 4.1, the seabed is primarily sandy and featureless along most of the Beagle Gulf portion of the proposed GEP route. From KP 0 to KP 100, the seabed appears to be primarily flat and almost featureless sand, crossed in several places by gullies. Around KP 105, where the GEP route enters Darwin Harbour, the flat sand gives way to rock outcrops and other hardgrounds. Between Larrakeyah and Mica Beach, the seabed becomes more gravelly and forms a thin cover over flat sandstone and phyllite pavements. The hardgrounds within Darwin Harbour are punctuated by isolated deposits of thick sediments, before giving way to sand and mudflats as the GEP approaches its terminus at Wickham Point.

5.3 Shipwrecks

The wrecking event is the first factor that influences site formation. Depending on the reasons or forces behind wrecking, the ship may be mostly complete or extensively broken up. A vessel rarely falls or sinks as a result of little or no damage; it is more likely that a vessel would run aground, cause damage to the hull, and then sink with part of the vessel intact and part damaged. Often the force of initial impact is sufficient to break the vessel and cause considerable damage. The vessel would then sink in large pieces, depending on the damage, or remain stuck until it is broken up by physical or human forces. Another reason for a wrecking event is fire which, depending on the extent, can cause a considerable amount of breaking up and scrambling of the ship material before it reaches the seabed.

It is reasonable to assume that a large majority of potential shipwrecks within the study area foundered or were forced ashore. In this scenario, the vessel's structural remains would remain highly intact, although if run ashore it may have been salvaged for key parts before discard and therefore would have less artefactual remains.

The seabed upon which a shipwreck lies has the greatest effect on site formation processes, in particular with wooden hulled vessels, with other factors also having contributory effects.

With regards to vessels coming to rest on a sandy seabed, the archaeological site will usually be formed in the following manner:

- Vessel comes to rest on the seabed.

- The wreck will settle into the seabed up to a certain depth, dependent on the resistance of the sediments and the weight of the vessel. It is a general rule, especially with iron hulled vessels, that wrecks sink into softer sediments up to their waterline.
- Parts of the vessel which protrude above the water may be salvaged for re-use. Non-perishable, accessible and high value parts of the vessel situated underwater may also be removed. It is a general rule that the deeper the water in which a vessel sinks and the more remote the location, the less likelihood of it being salvaged at the time of loss. Rapidly changing technology in recent times, however, has allowed salvage at greater depths.
- Biological processes will commence immediately on a timber wreck, attacking the exposed timbers and other organic elements of the wreck. This will lead to a weakening of the hull's integrity and eventually organic elements above the seabed will disappear.
- If it is in shallow water, wind generated waves would act upon the broader surfaces of a wreck thereby breaking down exposed components into sections. These sections will orientate themselves to prove the least resistance to the direction from which the waves are more commonly generated.
- Large waves will raise sediments into suspension, thereby resulting in cultural objects, including the hull of the wreck, sinking further into the marine sediments. The older the wreck the deeper it would be buried, unless a hard-alluvial substrate is present close to the surface of the seabed against which the wreck will rest.
- Cultural behaviour will have the effect of scrambling wreck sites and masking their presence. Dragging anchors, scallop dredgers and trawling will spread wreck material and may also result in the 'ploughing up' of buried cultural material.
- Salvaging will have a destructive effect on the hull and organic elements that have survived below the seabed, as well as by removing artefacts and creating a scatter of remaining material around the wreck site.

A wreck coming to rest on a rocky bottom would eventually collapse under its own weight as it would not be able to sink into the seabed. With such a collapse the integrity or coherence of the wreck begins to dissipate. Pockets of surviving structure and other artefacts can remain well preserved amongst boulders, gullies and depressions.

Assessing the condition or, more precisely, the structural integrity of the shipwrecks is of relevance because this can provide an indication of the nature and scale of the obstacle that could affect the pipeline installation process. Shipwreck condition also relates to its 'detectability'. A number of factors influence the condition of shipwrecks, the primary ones being the materials used in the construction of the vessel, the bottom type upon which the wreck rests, the depth of the wreck and its age.

With regards to detecting wreck sites, the two most common remote sensing techniques that are applied would be magnetometer and side scan sonar surveys. The side scan sonar would be more useful in detecting high- and low-profile wreck sites while the magnetometer is best employed in searching for sites with a high ferrous content which are partially buried or resting on a rocky bottom.

Generally speaking, the 'younger' the wreck is, and the deeper it sank in the water column, the better preserved it would be. Also, a wreck resting on a sandy bottom would be better preserved than if it was resting on a rocky bottom. In conjunction with these factors, the

method and type of construction of the vessel is the most important variable when it comes to assessing the condition of a wreck.

Iron/Steel Hulled Wrecks

If resting on a sandy bottom it could be expected that the hull integrity of the wreck would be relatively intact. The hull along midships may have collapsed but the stern and bow sections may still be upright or heeled to one side. The engine components, if any, would be largely intact and *in situ*. Such vessels on a rocky bottom would be relatively disarticulated, though the components of the vessel would still be present. Iron/steel wrecks on either bottom type can be detected using a magnetometer. Locating such a wreck site on a rocky bottom with side scan sonar would be difficult but the opposite is true with such wrecks on a sandy seabed.

Wooden Hulled Wrecks with Engines

In most cases the hulls of such wrecks would have disappeared. In situations, however, where the wreck rests on a sandy bottom, sections of the hull may have been preserved under the sand. The engine components of such wrecks would be visible. A magnetometer can detect such wrecks on either bottom type. Such wrecks on a rocky bottom would be difficult to detect with side scan sonar but the opposite can be true with such wrecks on a sandy seabed. However, engine components can be partially or completely covered by sediments and would appear as scattered dumped debris or a linear mound.

Large Tonnage (> 100 ton) Wooden Hulled Wrecks (Sail)

In most cases the hulls of such wrecks would have disappeared. In situations, however, where the wreck rests on a sandy bottom, significant sections of the hull may have been preserved under the sand. There would be enough ferrous material present, such as anchors, chain and winches, for such wreck sites to be detected using a magnetometer. The identification of such wreck sites using side scan sonar would be difficult as it could appear as scattered dumped debris, unless the cargo was non-perishable, in which case a linear mound may be visible.

Small Tonnage (< 100 ton) Wooden Hulled Wrecks (Sail)

The same as for large tonnage vessels except that the size of the target and the amount of ferrous material present would be considerably less. It would be difficult to detect using a magnetometer and may be mistaken for dumped material debris from side scan sonar imaging.

5.4 Aircraft Wrecks

There are significant differences between the site formation of underwater aircraft wrecks and shipwrecks due to the vastly different construction, in terms of both shape and material used, as well as the depositional process, i.e., the wrecking event. These are two key determining factors that will influence site formation.[89] The wrecking event for aircraft is the first factor affecting site formation, and can take many forms, from deliberate scuttling on the water's surface and dumping of material to high impact crashes and slower, more controlled ditching events. Aircraft dumping was considered 'fairly commonplace' following WWII, and significant dump sites exist near Sydney and Greencape in NSW, along with sites near Brisbane, and Rottnest Island in WA.[90] Aircraft wrecked as a result of military combat may have sustained significant damage before crashing into the water. Aircraft sitting on the

[89] **Burgess, A., 2013**, *Underwater Aviation Archaeology: What is its Place and Value Within Archaeology, and in Particular Maritime Archaeology?*, Masters thesis, Faculty of Humanities, University of Southampton, United Kingdom.
[90] **Smith, T., 2004,** Plane Sailing: The archaeology of aircraft losses over water in NSW, Australia. *Bulletin of the Australasian Institute for Maritime Archaeology.* Vol. 28:113-124.

surface of the water may have also been attacked and sunk through military action.[91] The initial integrity of the aircraft hull depends largely on the wrecking incident, and is influenced by numerous factors, such as the speed and angle of impact upon entry.

Upon entering the water, the shape of the aircraft and the depth of the water column will determine how the aircraft comes to rest on the seafloor. Aircraft hulls and wings are typically made of lightweight material, such as aluminium or even wood and fabric, while machinery and components such as engines will weigh significantly more and contain more ferrous elements. This disparity in weight will cause some aircraft to invert on descent, coming to a rest on their back. Other aircraft, such as single engine WWII fighter planes built with engines at the front, will sink to the bottom nose first. As the aircraft sinks in the water column, it may break up further, with the loss of wings or tail sections being sometimes noted.[92] Once on the seafloor, the combination of increased weight and galvanic corrosion due to differing metals means that larger components, such as engines, may detach and fall away from the rest of the structure. The depth of the wreck has a significant role in its deterioration, as aircraft sunk in shallower waters are more at risk from wave surge and corrosion due to warmer water temperature and increased oxygen levels.[93]

The seafloor composition will determine the burial environment for a sunken aircraft which in turn will have a large impact on the survival and condition of the aircraft. Aircraft are generally lighter than ships and are therefore less likely to penetrate the seabed, and less of the hull may be buried. As with shipwrecks, it is assumed that aircraft that are quickly buried in an anaerobic, stable environment, deep underwater will be better preserved than those in shallow inshore environments, particularly those with hard seabed and heavy surf.[94]

The composition of alloys used in aircraft construction can have a significant impact on the rate of deterioration once an aircraft has sunk. Aluminium, the primary material used in aircraft construction, is highly reactive. When alloyed with metals like copper, its corrosion rate is accelerated. This leads to a phenomenon known as ‘pitting,’ where perforations appear as the aluminium corrodes.[95] Water with a higher acidity will cause more rapid deterioration.

Direct cultural impacts can also play a role in site formation, especially on sites located in areas of high boat traffic. Fishing nets have frequently become entangled with aircraft wrecks, resulting in damage and fragmentation.[96] Impacts and damage by anchors was frequently noted on PBY Catalina wrecks in Darwin Harbour, including some anchors that remained embedded in the aircraft.[97] Further damage can occur from propeller jet turbulence in shallow water. Due to the lightweight construction of aircraft, these anchor and fishing net collisions can easily move pieces of a sunken aircraft from one location to another, resulting in highly fragmented wreck sites.[98] Aircraft parts can be light enough that even recreational fishing line has been known to snag and disturb sites. Seafloor dredging has also been shown to have a significant negative impact on aircraft crash sites.[99] Other cultural impacts include salvaging, which can include initial salvaging efforts shortly after the wrecking event, as well as looting, illicit salvage, and souvenir taking. Sunken aircraft may become popular with recreational divers and can be damaged by careless visitors.

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[91] **Wilkinson, D., 2012,** Underwater aircraft sites in Australia: a summary of what has been learnt so far. *Bulletin of the Australasian Institute for Maritime Archaeology.* Vol. 36:31-35.
[92] **Wessex Archaeology, 2008,** *Aircraft Crash Sites at Sea: A Scoping Study,* Prepared for English Heritage.
[93] *Op. Cit.* **Smith, 2004.**
[94] *Op. Cit.* **Wessex Archaeology, 2008**.
[95] *Op. Cit.* **Burgess, 2013**.
[96] *Op. Cit.* **Smith, 2004.**
[97] **Cosmos Archaeology, 2016,** *INPEX Ichthys Project, Catalina Flying-Boat Monitoring 2012 to 2015,* Prepared for Tek Ventures Pty Ltd.
[98] *Op. Cit.* **Cosmos Archaeology, 2016**.
[99] *Op. Cit.* **Wessex Archaeology, 2008**.

Although the site formation processes for sunken aircraft display large variation between sites, a general flow of deposition can be summarized:

- An aircraft enters the water, either through a violent and high-impact uncontrolled crash, slower deliberate bailout, or through dumping/scuttling on the surface. Aircraft may have sustained damage prior to entering water, such as those suffering mid-air explosions and aircraft shot down in combat.
- As the aircraft sinks, its orientation and hull integrity will change depending on its construction. Wings and tail may separate, and heavier components may invert an aircraft.
    - It has been noted on Catalina wrecks that the tails and wings are very rarely found with the rest of the fuselage, indicating that they have potentially broken off and drifted away as the aircraft sunk.[100]
- The aircraft will settle on the sea bottom. Aircraft deposited on hard substrate may not be buried, while those settling on sandy, muddy, or silty bottoms may partially sink into the seafloor.
- In certain cases, salvaging operations may take place immediately, including the removal of high value components. In other cases, illicit salvaging, looting, treasure hunting, and souvenir taking can damage wrecks.
- Aircraft materials will begin to deteriorate over time, due to corrosion as well as natural and cultural external factors.
    - Corrosion will cause deterioration of metals, particularly aluminium, and may cause heavier ferrous components to detach.
    - Surf and surge can further disarticulate aircraft and spread material around a larger area.
    - Human activities such as dredging, fishing and recreational boating can further disperse sites by dragging fishing nets and anchors across sunken aircraft.

5.5 Sea dumping and UXO

Ordnance from WWII

Generally, ordnance resting on rocky seabeds in high energy environments will corrode and disintegrate at a more rapid rate while those in lower energy environments or completely buried will retain their integrity for much longer.[101] Such objects will appear as scattered low relief and highly reflective debris on the seabed.

Ballast mounds

Ballast mounds are usually composed of rock and occasionally of scrap iron. They will present as high relief and highly reflective on the seabed.

5.6 Maritime Infrastructure

Moorings

Moorings are selected for their durability and therefore remain in a solid condition, whether they be anchors or concrete blocks. They tend to become buried over time in sandy/silty seabeds. Associated chain can also become buried, with exposed sections eventually corroding to a point where they become brittle and break easily. The length of time required

[100] *Op. Cit.* **Cosmos Archaeology, 2016**.
[101] **G-tek Australia, 2010:6.**

for chain to reach this state of deterioration depends very much on its thickness, but it can be expected that such material in Darwin Harbour will still retain some tensile strength.

Cable and nets

On a sandy/silty seabed, wire and netting can become partially buried. Similarly, to chain, exposed sections eventually corrode to a point where they become brittle and break easily, but the length of time required to reach this state of deterioration depends very much on the object's thickness. Given that these objects are around 70 years old, they can be expected to still retain tensile strength. They would appear as meandering low relief and highly reflective linear anomalies. The associated 'clumps' would appear as round or square low relief and highly reflective objects.

6 REVIEW OF GEOPHYSICAL SURVEY DATA

6.1 Introduction

Geophysical data was provided by Santos in the form of high-resolution geo-tiffs for side scan sonar (SSS) and multi-beam echosounder (MBES) survey data. Magnetometer data was provided as georeferenced feature points. Additionally, a detailed geophysical survey report was provided to supplement the raw data.[102] The proposed anchoring corridor for vessels installing the GEP is wider than the geophysical survey corridor conducted by Fugro. Therefore, an additional MBES dataset published by Geosciences Australia was consulted to cover this data gap.

Of relevance to this assessment in particular was the SSS. Additionally, MBES and magnetometer data was used as a second and third data source to support the selection of targets from SSS. SSS data was provided as geo-tiffs at 0.5m resolution which were imported into QGIS software and laid over basemaps. This provided highly accurate coordinates of seabed anomalies as well as their dimensions. The 0.5m resolution allowed for the selection of small, isolated anomalies due to the high resolution.

SSS and MBES data adequately covered the proposed pipeline route, with no discernible gaps in coverage. Magnetometer data, though useful in identifying cultural objects, was provided only as feature points, and raw data was not provided.

6.2 Geophysical survey data provided

6.2.1 *Side Scan Sonar survey*

SSS data was provided as 0.5m resolution black and white geo-tiffs covering the entirety of the proposed GEP route (see Figure 36 and Figure 37). Additionally, targets identified by FUGRO during geophysical survey reporting were provided. These were assessed against the available raw SSS and MBES data to assess their potential historical significance and cultural origin (see Table 7).

[102] **Fugro, 2022,** *Barossa Pipeline to Shore Project – Survey Results Report – Offshore Geophysical Survey – (Work Package 1) North Route 2*, provided for Santos Pty Ltd. (BAS-200 0629).

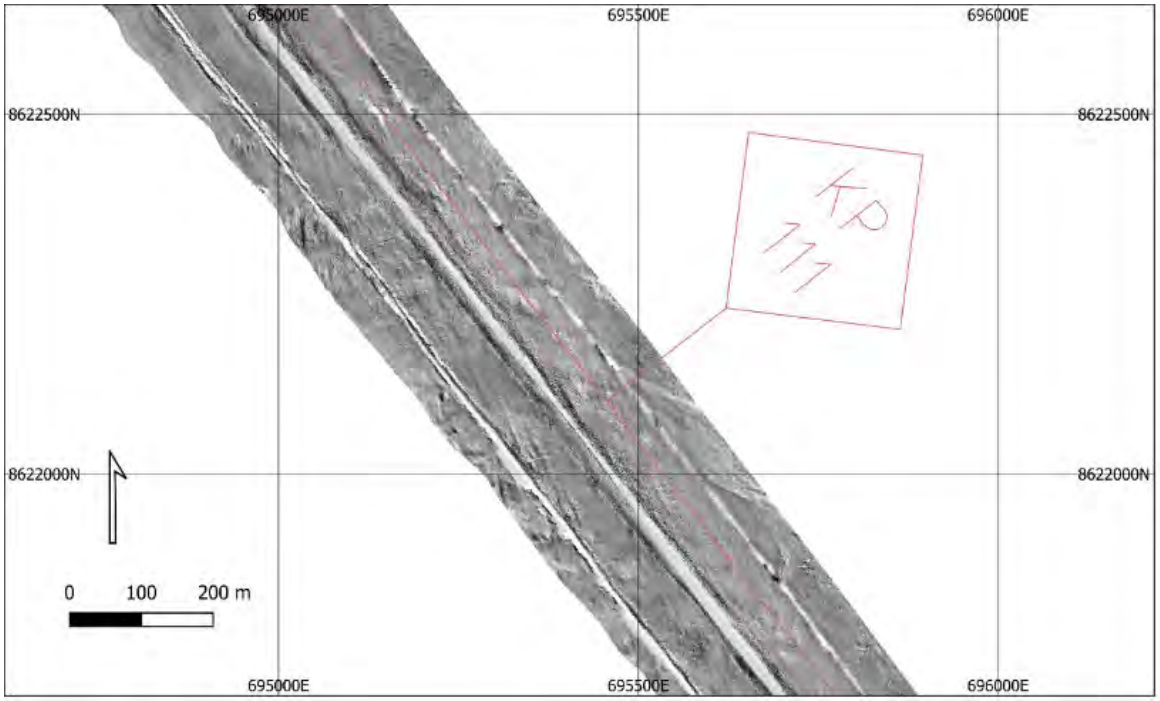


Figure 36: Detail example of SSS data at KP 111.

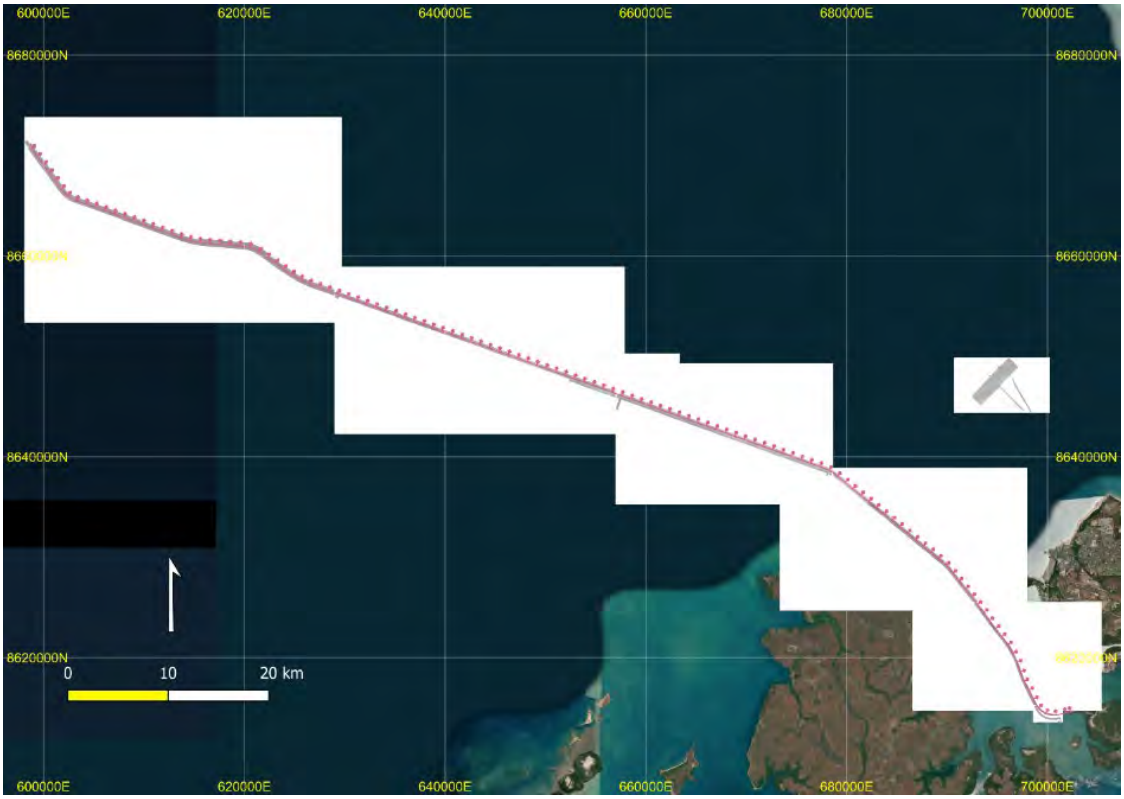


Figure 37: Overview of SSS data provided. Isolated survey location at upper right is proposed spoil dumping ground and has not been assessed as part of this study.

Table 7: SSS targets identified by FUGRO.

Contact ID	Easting	Northing	KP	Lateral Offset (m)	Target Length (m)	Target Width (m)	Target Height (m)	Comments
NCL_SC_001	700 423.74	8 614 259.84	120.575	14.2	2	0.6	0.5	Interpreted as possible debris
NCL_SC_002	698 297.94	8 616 489.78	117.323	-11.6	0.9	0.4	0.3	Interpreted as possible debris
NCL_SC_003	696 916.66	8 619 697.08	113.822	-18.7	1	0.9	0.5	Likely Cable Support
NCL_SC_004	696 907.83	8 619 708.85	113.807	-15.9	1	1	0.6	Likely Cable Support with indicated floating feature
NCL_SC_005	696 407.33	8 620 690.74	112.705	-0.2	5.4	4.8	2.2	Interpreted area of boulders
NCL_SC_006	696 419.44	8 620 731.18	112.674	-28.9	15.2	2.6	4.1	Interpreted area of boulders
NCL_SC_007	696 392.69	8 620 736.62	112.658	-7.3	37.9	4.8	4.1	Interpreted area of boulders
NCL_SC_008	695 229.68	8 622 439.49	110.594	-29.6	4.4	4.2	2.3	Interpreted as possible boulder
NCL_SC_009	695 133.04	8 622 512.87	110.476	1.6	19.4	9.8	2.2	Interpreted area of boulders
NCL_SC_010	694 982.00	8 622 822.59	110.139	-69.5	17.2	0.4	0.0	Interpreted as linear debris
NCL_SC_011	694 570.93	8 623 163.28	109.618	45.6	7.9	3	0.0	GEP Support
NCL_SC_012	694 554.56	8 623 338.56	109.47	-49.1	1.7	0.6	0.5	Interpreted as possible debris
NCL_SC_013	694 194.43	8 623 694.54	108.967	16.4	2.4	0.9	0.3	Interpreted as possible debris
NCL_SC_014	694 154.18	8 623 697.79	108.94	46.1	5.6	3.1	0.0	GEP Support
NCL_SC_015	694 149.50	8 623 705.26	108.931	45.2	4.8	3.1	0.0	GEP Support
NCL_SC_016	694 168.64	8 623 820.49	108.85	-39.5	3.5	1.6	0.3	Likely Cable Support
NCL_SC_017	693 408.43	8 624 885.18	107.544	-42.5	2.2	1.6	1.6	Likely Cable Support
NCL_SC_018	693 397.60	8 624 896.59	107.528	-41.6	3.7	1.5	1.6	Likely Cable Support
NCL_SC_019	693 392.07	8 624 908.88	107.515	-45.2	3.2	0.5	0.5	Likely Cable Support
NCL_SC_020	693 289.83	8 624 881.53	107.472	51.4	1.2	0.7	1.0	Likely Cable Support
NCL_SC_021	693 256.72	8 625 008.55	107.351	-0.7	1.2	0.7	0.3	Likely Cable Crossing
NCL_SC_022	693 204.05	8 625 169.57	107.192	-57.9	7.3	0.5	0.8	Likely rock outcrop
NCL_SC_023	693 194.32	8 625 167.23	107.188	-48.7	3.3	3	1.4	Likely Cable Support
NCL_SC_024	693 197.88	8 625 175.94	107.183	-56.9	1.6	1.2	0.6	Likely as possible boulder
NCL_SC_025	693 173.38	8 625 221.05	107.133	-65.2	2.4	1.2	0.6	Likely Cable Support
NCL_SC_026	693 033.94	8 625 246.57	107.027	29.2	2.2	1.1	2.1	Likely Cable Support
NCL_SC_027	692 377.30	8 626 358.51	105.749	-140.6	3.8	0.6	0.5	Interpreted as possible debris
NCL_SC_028	692 201.01	8 626 347.87	105.646	2.8	5.9	1.7	0.3	Interpreted as possible boulders
NCL_SC_029	692 113.89	8 626 472.65	105.494	-8.4	7.3	4.9	1.0	Interpreted as possible boulders
NCL_SC_030	692 203.88	8 626 576.45	105.471	-143.7	2.7	0.5	0.8	Interpreted possible depression
NCL_SC_031	691 780.61	8 626 909.95	104.945	-26	1.4	0.7	0.3	Interpreted as possible debris
NCL_SC_032	691 794.14	8 626 925.97	104.941	-46.6	5.9	3.9	0.7	Interpreted seabed depression
NCL_SC_033	691 531.47	8 627 231.14	104.538	-35.5	3.9	3	0.5	Interpreted as boulders area
NCL_SC_034	690 883.80	8 628 009.18	103.526	-18.2	2.4	2.2	1.8	Interpreted as possible boulders
NCL_SC_035	690 884.02	8 628 053.80	103.49	-45.7	5.4	3.4	0.5	Interpreted as possible debris
NCL_SC_036	690 874.11	8 628 054.11	103.484	-38.1	3.2	2.1	1.4	Interpreted as possible boulders
NCL_SC_037	690 850.08	8 628 066.18	103.46	-26.5	6.4	2.1	1.4	Interpreted as possible boulders

Contact ID	Easting	Northing	KP	Lateral Offset (m)	Target Length (m)	Target Width (m)	Target Height (m)	Comments
NCL_SC_038	690 694.00	8 628 289.49	103.188	-40.4	4.3	3.1	1.2	Interpreted as possible boulder
NCL_SC_039	690 654.94	8 628 293.38	103.161	-11.9	10.8	9.1	2.2	Interpreted as possible boulders
NCL_SC_040	690 656.57	8 628 303.24	103.154	-19.3	3.4	1.6	1.3	Interpreted as possible boulders
NCL_SC_041	690 751.17	8 628 441.21	103.103	-178.6	18.5	7.2	0.6	Unknown contact
NCL_SC_042	690 507.00	8 628 467.70	102.932	-2.1	4.7	3.3	1.5	Interpreted as possible boulder
NCL_SC_043	690 594.22	8 628 586.13	102.892	-143.7	5.6	1.6	1.1	Interpreted as possible item of debris
NCL_SC_044	690 589.91	8 628 584.83	102.891	-139.5	4	1.3	0.9	Interpreted as possible debris
NCL_SC_045	690 572.03	8 628 605.50	102.863	-138	5.2	1.7	0.9	Interpreted as possible debris
NCL_SC_046	690 576.71	8 628 624.49	102.851	-153.4	5	1.4	0.3	Interpreted as possible debris
NCL_SC_047	689 666.39	8 629 478.40	101.621	-47	22.8	0	0.0	Interpreted as possible linear debris
NCL_SC_048	689 718.75	8 629 576.50	101.595	-155	2.3	1.2	0.4	Interpreted as possible debris
NCL_SC_050	689 665.26	8 629 484.58	101.616	-50.9	1.9	1.6	1.5	Interpreted as possible debris
NCL_SC_049	681 875.94	8 635 783.35	91.6	-1.89	2.47	0.32	NA	Possible linear contact, Debris

6.2.2 *Multi-beam sonar*

Multi-beam bathymetry for the entire route was provided as high-resolution geo-tiffs with colouring and shading to designate elevation changes. MBES resolution was 0.5m.

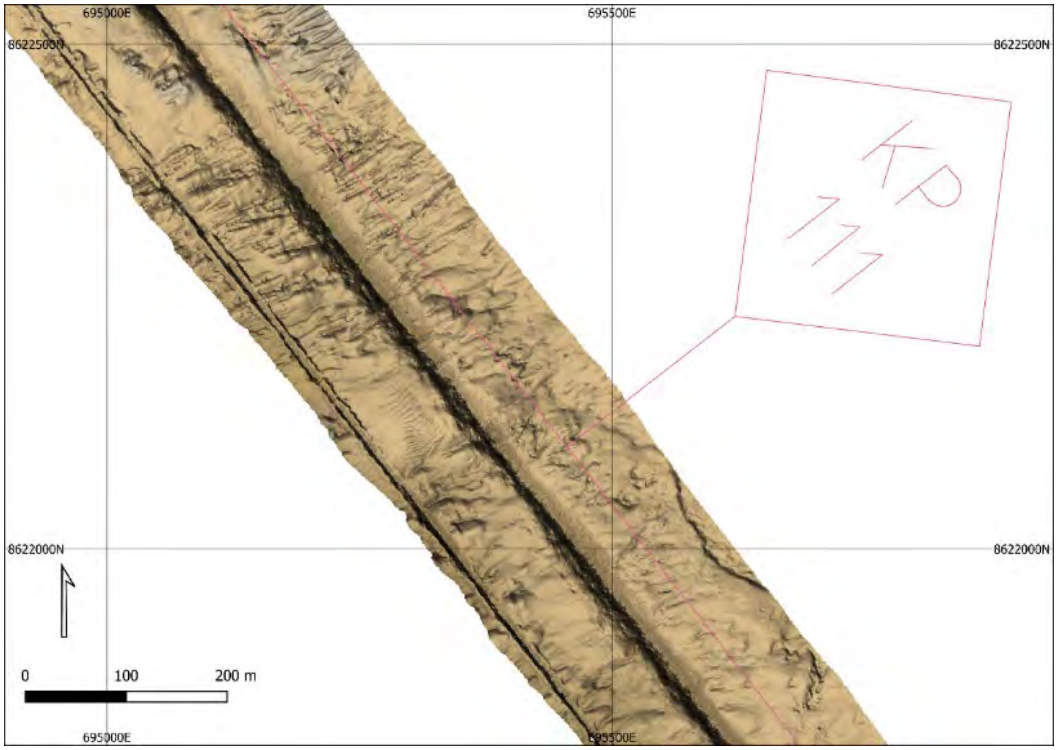


Figure 38: Example of MBES data provided at KP 111. Note INPEX GEP and Bayu-Undan pipeline clearly visible.

A second set of multi-beam data was provided 13 April 2022 as an XYZ data file. This second set of data was recorded by FUGRO in 2021 and is higher resolution (0.25m). The

second MBES data set covers roughly the last third of the proposed pipeline route, from approximately KP 87 to the terminus.

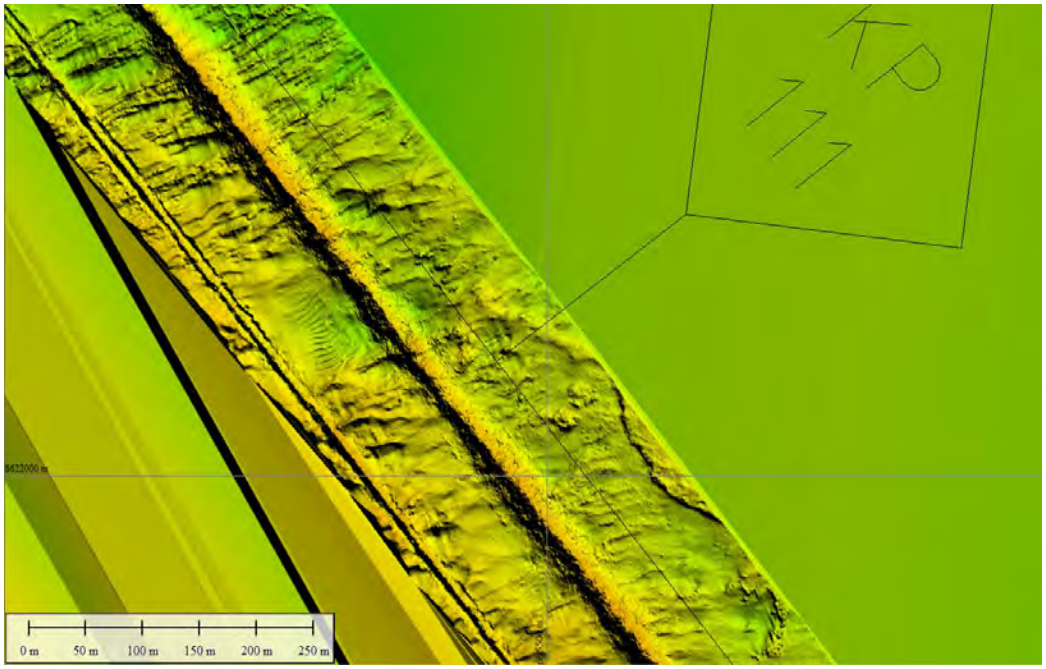


Figure 39: Example of 2022 MBES data with higher resolution (0.25m) in approximately the same location as previous figure.

The anchoring corridor for the proposed works, located between KP 91.5 and the terminus, is wider than the geophysical survey corridor. Therefore, public MBES data covering the entirety of Darwin Harbour was examined to identify underwater cultural heritage located in the area between the Fugro survey corridor and the anchoring corridor (see Figure 40 and Figure 41). This publicly available dataset is published by Geoscience Australia and consists of 1 m resolution gridded MBES data.[103]

[103] **Siwabessy, P.J.W., Smit, N., Nicholas, W.A., Nansen, R., Picard, K. 2020.** Data package – Darwin Harbour Habitat Mapping Program, Northern Territory. Geoscience Australia, Canberra. http://pid.geoscience.gov.au/dataset/ga/127494.

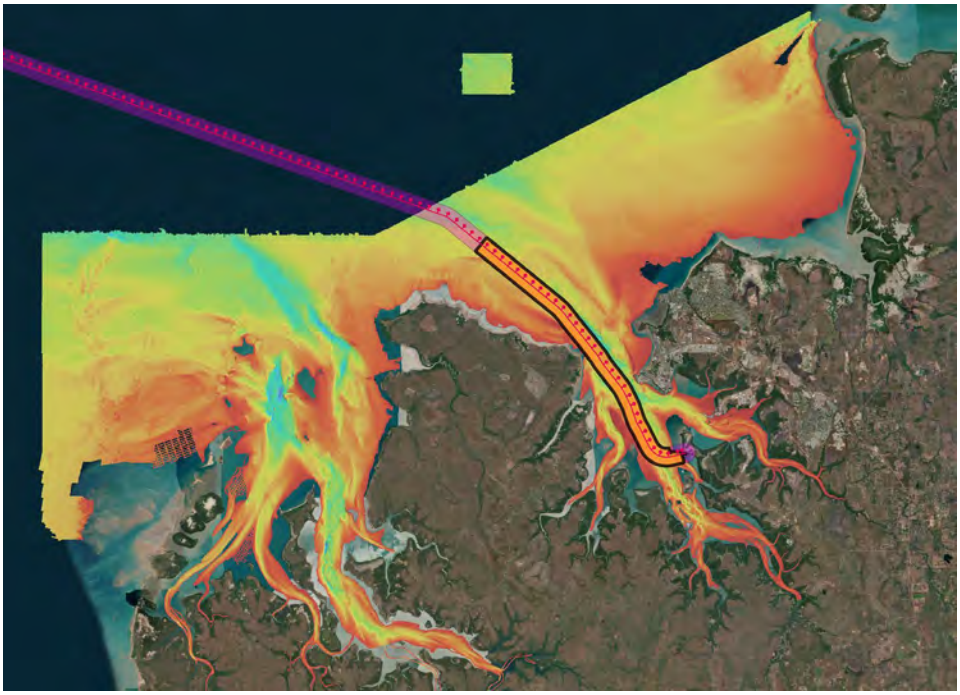


Figure 40: Overview of total coverage of public Darwin Harbour MBES data. Study area in purple, anchoring corridor in orange.

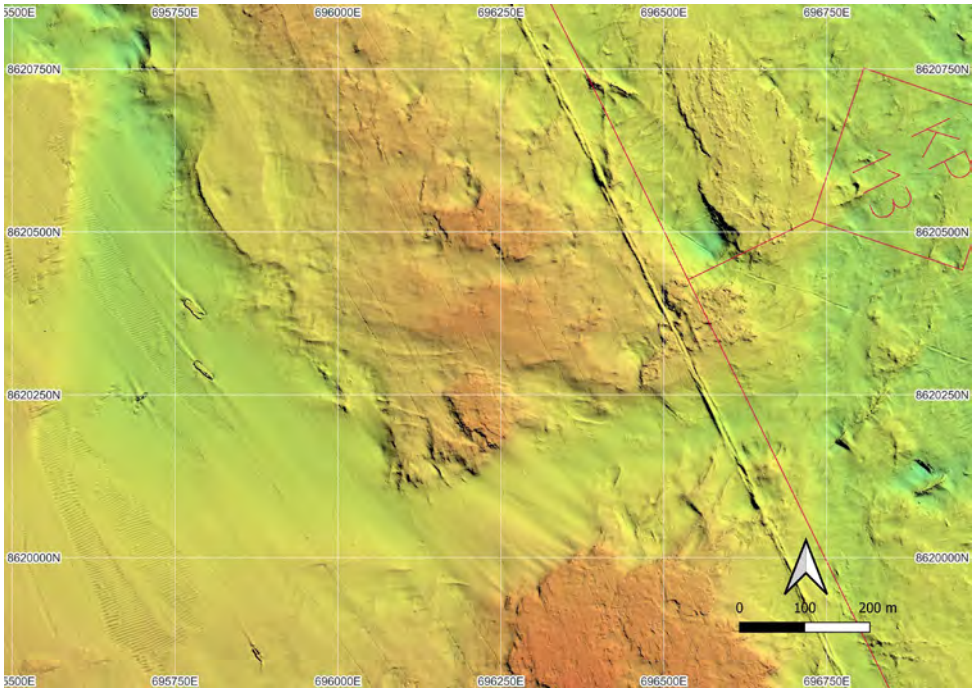


Figure 41: Detail of same dataset at KP 113, showing GEP route and several shipwrecks at left.

6.2.3 *Magnetometer*

Magnetometer data was collected from a single channel mag and provided as a shapefile of georeferenced points. Additionally, the same magnetic anomaly contacts were provided as part of a report delivered by FUGRO in April 2022 (see Table 8).[104]

Magnetometer data was collected using a SeaSpy magnetometer deployed behind the combined SSS/SBP system via an 11m long cable. Altitude of the magnetometer was approximately 1.5m lower than that of the SSS/SBP, and therefore achieved results at elevations less than ~10m above the seafloor.[105]

Due to the tow height and line spacing of the MAG survey, actual locations of magnetic contacts given are approximate and may not be located directly below survey lines. Their locations are proportional to the distance of the magnetic sensor to detected object. Therefore, actual magnetic contacts may be laterally offset to the magnetic survey lines.[106]

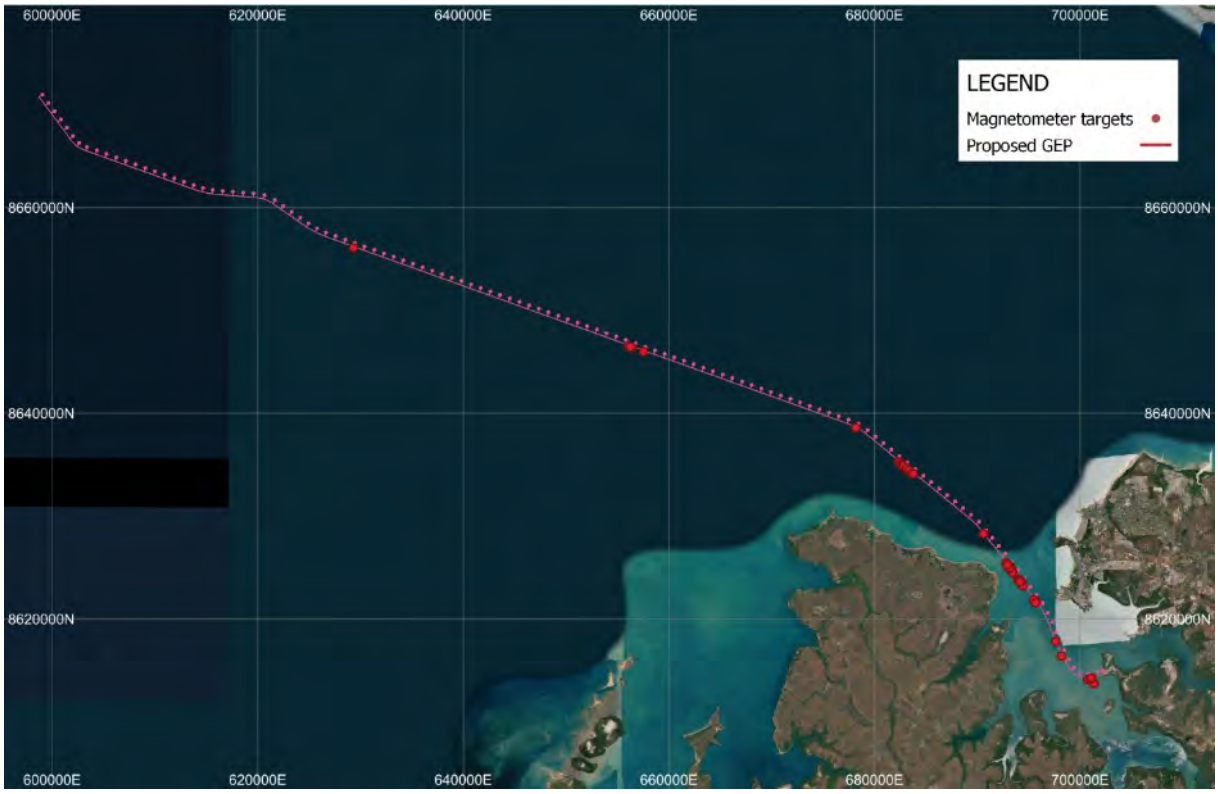


Figure 42: Locations of magnetometer targets provided by FUGRO survey.

Table 8: List of magnetometer strikes provided by FUGRO.

Contact ID	Easting	Northing	KP	Lateral Offset	Magnetic Intensity (nT)	Magnetic sensor altitude	Comments
MA_051	629 303.20	8 656 083.30	35.014	112.6	36.8	20	Bayu-Undan GEP
MA_038	682 530.80	8 635 126.40	92.524	93	225.7	13.5	Bayu-Undan GEP
MA_039	682 697.00	8 634 980.60	92.745	100.9	596.4	10.2	Bayu-Undan and Icthys GEPs
MA_040	682 824.80	8 634 880.90	92.907	97.3	168.3	15.2	Bayu-Undan GEP

[104] **FUGRO, 2022,** *Results Report – North Route 2 – Offshore Geophysical Survey (Work Package 1): Barossa Pipeline to Shore Project, Darwin,* report prepared for Santos NA Barossa Pty Ltd.
[105] *Op. Cit.* **FUGRO, 2022:**13.
[106] *Op. Cit.* **FUGRO, 2022:**14.

Contact ID	Easting	Northing	KP	Lateral Offset	Magnetic Intensity (nT)	Magnetic sensor altitude	Comments
MA_041	682 820.00	8 634 759.60	92.980	194.3	139.5	10.8	Icthys GEP
MA_042	683 109.80	8 634 510.30	93.362	204.3	47.1	16.2	Icthys GEP
MA_043	683 119.80	8 634 630.10	93.294	105.1	42.7	18.2	Bayu-Undan GEP
MA_044	683 371.80	8 634 440.50	93.609	92.7	182.1	12.3	Bayu-Undan GEP
MA_045	683 329.80	8 634 341.30	93.640	196.1	101.9	14	Ichthys GEP
MA_046	683 585.80	8 634 131.90	93.970	196.5	302.8	12	Ichthys GEP
MA_047	683 772.10	8 634 111.30	94.128	94.6	88.6	15	Bayu-Undan GEP
MA_048	656 411.80	8 646 395.20	63.802	96.3	22.4	6.2	Bayu-Undan GEP
MA_049	656 056.10	8 646 529.60	63.422	89.6	119.5	25.1	Bayu-Undan GEP
MA_050	656 258.10	8 646 432.00	63.645	113.4	31.7	16.3	Bayu-Undan GEP
MA_052	657 533.60	8 645 980.50	64.998	108.6	33.2	9.4	Bayu-Undan GEP
MA_053	678 201.60	8 638 571.20	86.966	94.3	16.3	25.7	Bayu-Undan GEP
MA_001	697 628.20	8 617 803.70	115.846	-35.3	13.3	14.2	Inferred Buried Debris
MA_002	693 037.60	8 625 230.40	107.042	36.3	33.6	19.4	Inferred Cable Infrastructure
MA_003	693 280.20	8 624 938.20	107.421	24	19.1	26.5	Inferred Cable
MA_004	694 088.70	8 623 805.80	108.816	34.2	23.8	29.2	Inferred Cable
MA_005	694 270.00	8 623 584.10	109.101	24.6	11.2	28.1	Inferred Cable
MA_006	694 340.30	8 623 487.70	109.22	28.3	53	27.7	Inferred Cable
MA_007	695 763.20	8 621 695.50	111.508	6.4	21.5	17.1	Inferred Buried Debris
MA_008	694 368.90	8 623 483.00	109.241	8.6	2.4	21.8	Inferred Cable
MA_009	694 288.70	8 623 586.70	109.11	8.2	10	22	Inferred Cable
MA_010	694 195.20	8 623 712.20	108.954	4.9	45.7	24.7	Inferred Cable
MA_011	693 259.90	8 625 000.50	107.36	1.8	10.1	19.6	Inferred Cable
MA_012	693 160.20	8 625 119.90	107.204	7.2	13.9	14.7	Inferred Buried Debris
MA_013	693 294.80	8 624 761.80	107.565	123.9	57.9	22	Inferred Buried Debris
MA_014	693 327.90	8 624 726.50	107.613	121.4	68.3	20.4	Inferred Buried Debris
MA_015	693 395.30	8 624 640.10	107.723	125.6	101.2	20.8	Inferred Buried Debris
MA_016	693 438.60	8 624 583.40	107.794	129.1	46.3	21.8	Inferred Buried Debris
MA_017	694 427.20	8 623 200.30	109.5	136.2	94.9	20.5	Inferred Cable
MA_018	694 230.10	8 623 485.50	109.154	116.6	33.1	21.9	Inferred Cable
MA_019	694 143.00	8 623 584.60	109.023	124.5	13.5	23.8	Inferred Cable
MA_020	694 041.00	8 623 720.90	108.857	122.3	19.2	23.6	Inferred Cable
MA_021	695 672.30	8 621 568.70	111.553	156	148.8	17.1	Inferred Buried Debris
MA_022	695 454.30	8 621 871.00	111.18	142.3	177.5	21.1	Inferred Buried Debris
MA_023	693 904.20	8 623 870.50	108.663	152.2	802.4	25.1	Inferred Buried Debris
MA_024	694 000.90	8 623 742.90	108.816	142.2	46.5	26.5	Inferred Cable
MA_025	693 425.00	8 624 481.80	107.863	205	137.4	10.1	Inferred Buried Debris
MA_026	693 264.60	8 624 703.70	107.59	184.4	66.8	18	Inferred Buried Debris
MA_027	692 796.90	8 625 441.70	106.727	96.7	936.1	18.6	Bayu-Undan GEP
MA_028	693 130.70	8 624 923.90	107.341	150.8	33.2	18.4	Inferred Cable
MA_029	694 058.20	8 623 721.40	108.864	108.1	30.9	27.2	Inferred Cable

Contact ID	Easting	Northing	KP	Lateral Offset	Magnetic Intensity (nT)	Magnetic sensor altitude	Comments
MA_030	694 165.40	8 623 591.30	109.031	102.7	6.6	25.8	Inferred Cable
MA_031	698 180.90	8 616 372.60	117.376	145.6	34.3	14.6	Inferred Buried Debris
MA_032	701 103.60	8 614 208.70	121.233	106.2	2.4	19.5	Bayu-Undan GEP
MA_033	700 725.60	8 614 092.30	120.866	172.1	16.4	14.5	Bayu-Undan GEP
MA_034	701 167.90	8 614 234.30	121.3	96.1	285.3	10.8	Bayu-Undan GEP
MA_035	701 039.40	8 614 186.30	121.169	115	330.6	16.4	Bayu-Undan GEP
MA_036	701 078.90	8 614 217.70	121.211	91.9	2.1	15.9	Bayu-Undan GEP
MA_037	701 335.50	8 613 704.20	121.335	650.9	32.1	18.3	Ichthys GEP
MA_054	692 947.20	8 625 244.60	106.975	98.9	58.7	5.3	Bayu-Undan GEP
MA_055	692 865.40	8 625 182.90	106.974	201.4	15.3	14.9	Ichthys GEP

6.3 Anomaly Identification

The following table shows the identified geophysical targets, arranged in their priority level for visual survey. The priority level is defined as:

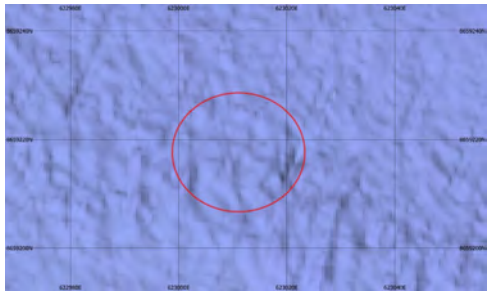
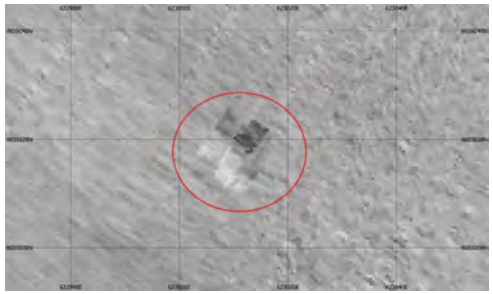
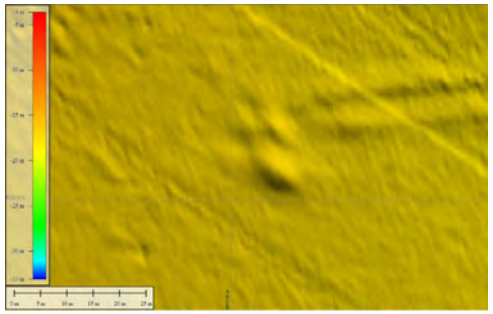
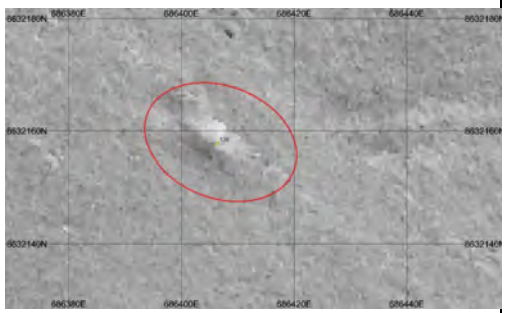
A = Primary – Identified as most likely cultural (unlikely but possibly natural), significance determined by dive survey or ROV

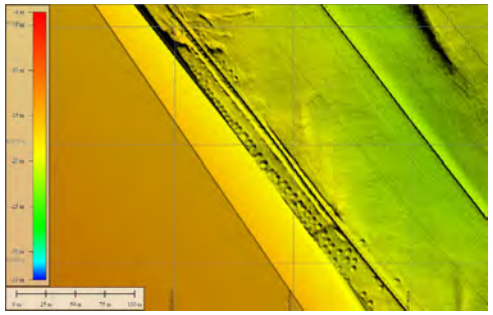
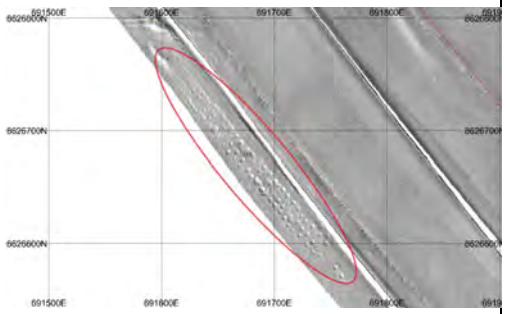
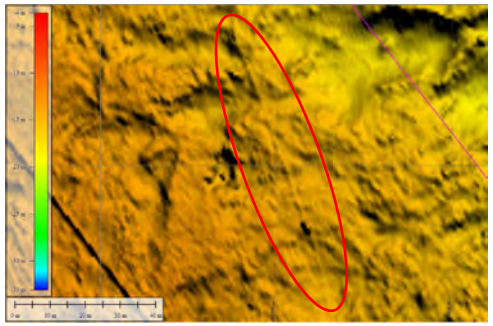
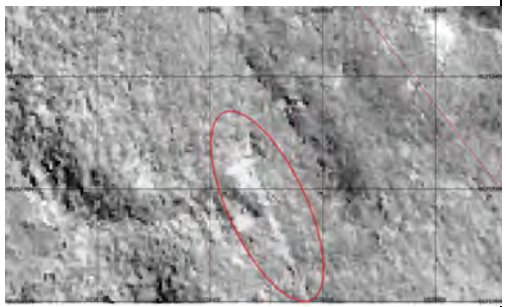
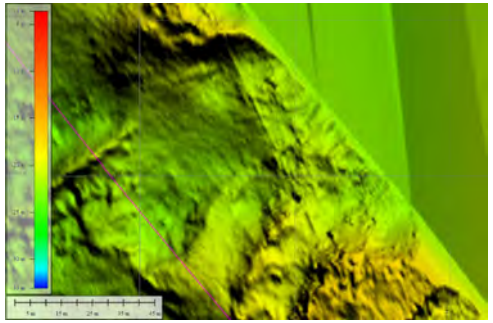
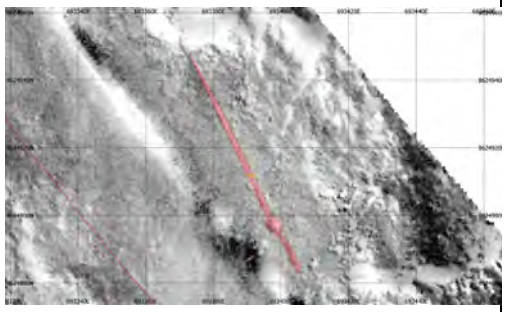
B = Secondary – Possibly cultural, possibly natural, significance determined by dive survey or ROV

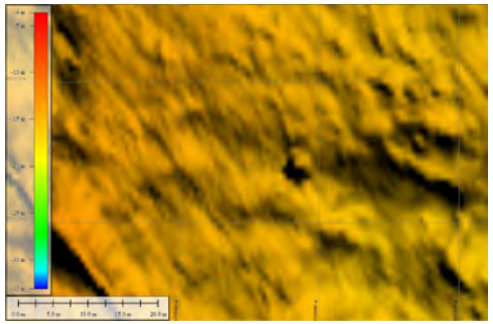
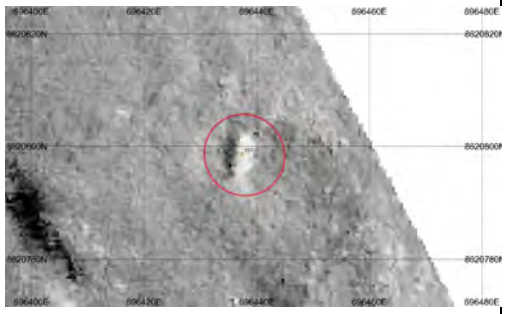
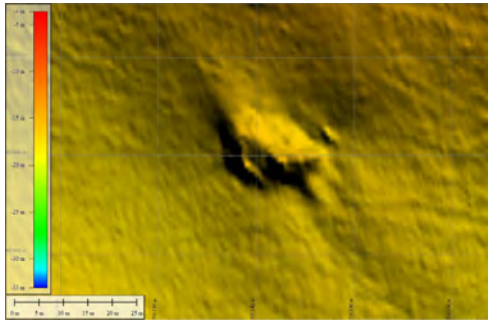
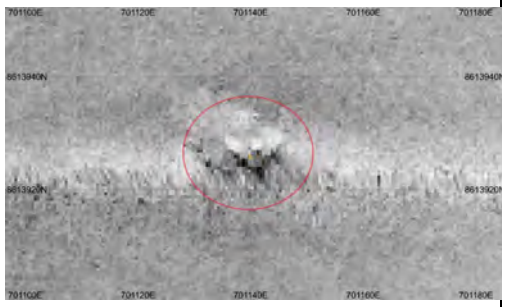
C = Low priority – Identified features determined to be not culturally significant

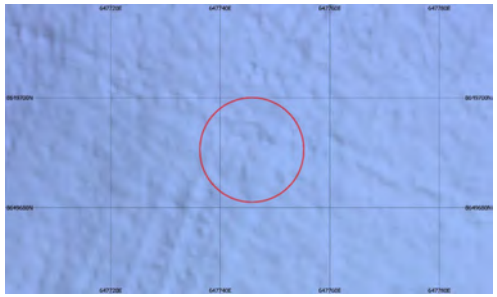
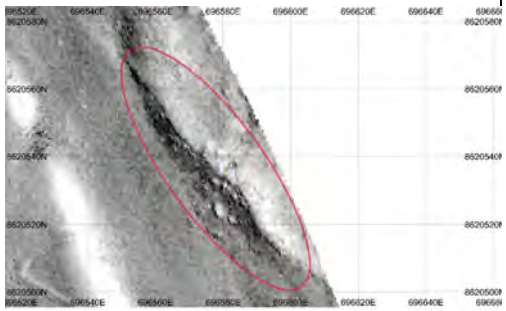
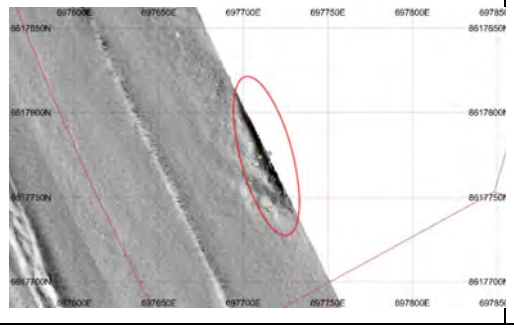
All images are oriented with north at the top. Where available, imagery from the 2022 MBES survey is used. Targets identified by CA are correlated with targets identified by FUGRO where appropriate. Targets surveyed during ROV surveys have IDs marked with *.

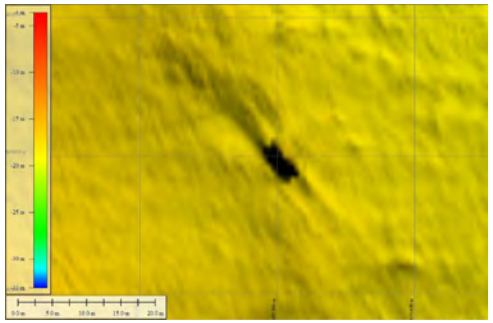
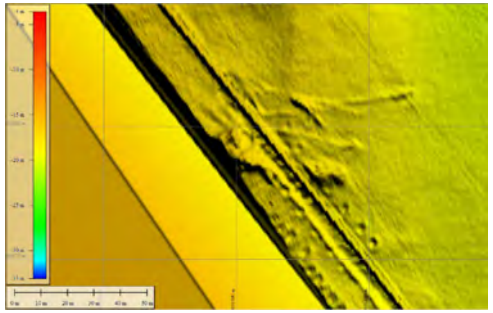
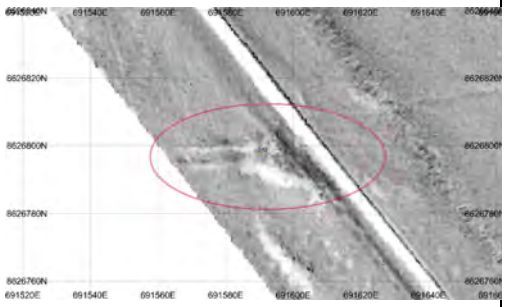
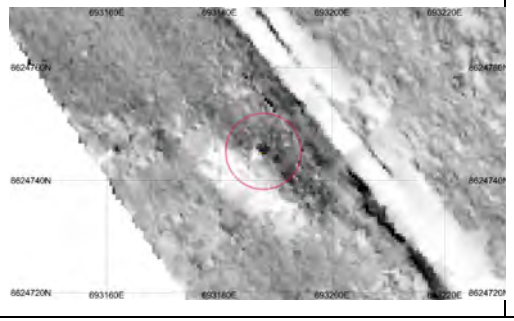
6.3.1 *Targets within survey corridor*

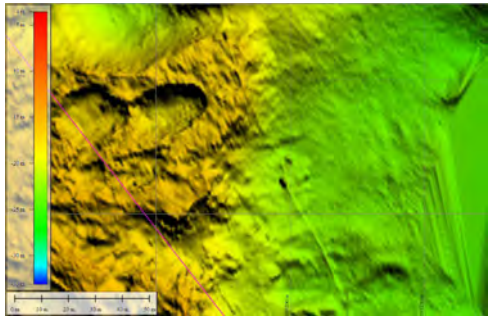
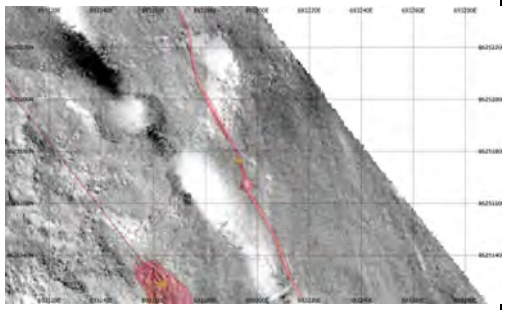
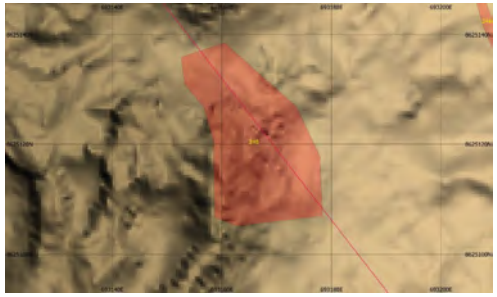
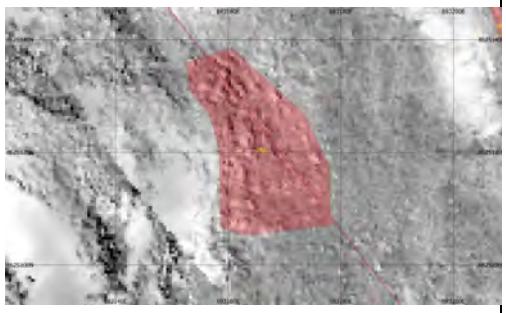
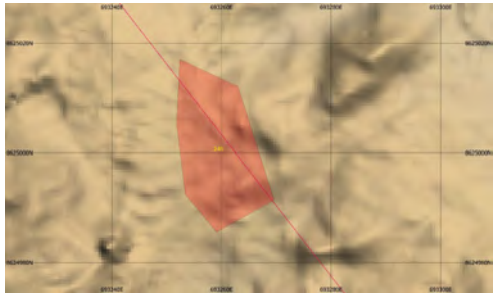
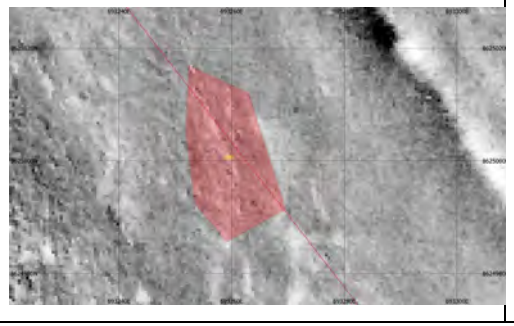
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	112	623 013.42	8 659 220.00			No	Single object of high relief. Possible debris related to I-124.	Length: 8m Width: 6m	46m	68m
A	138	686 407.37	8 632 159.33			No	Mound associated with anchor scars	Length: 13m Width: 16m	17m	59m

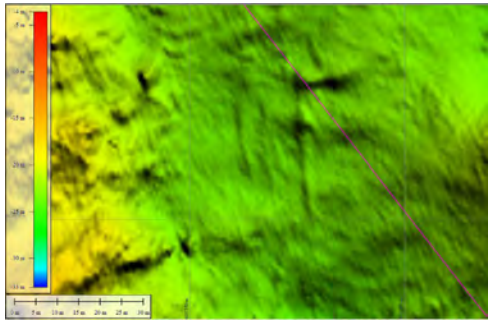
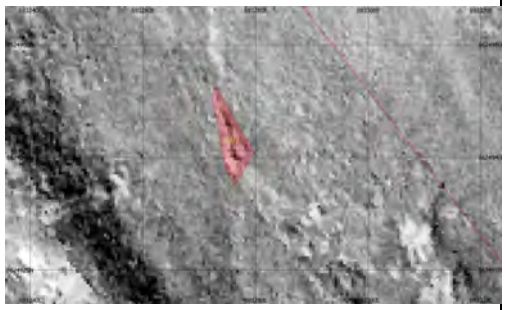
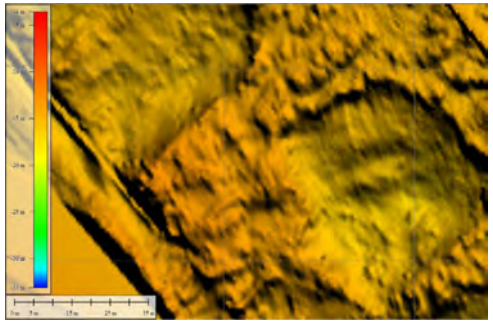
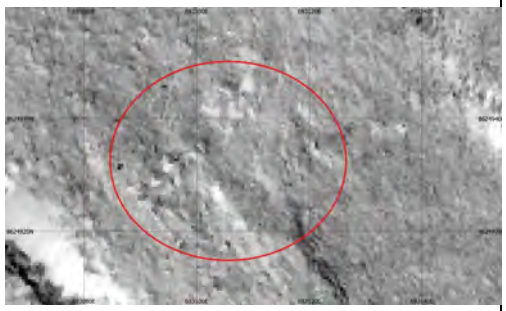
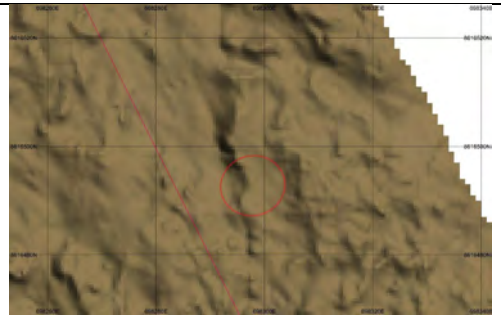
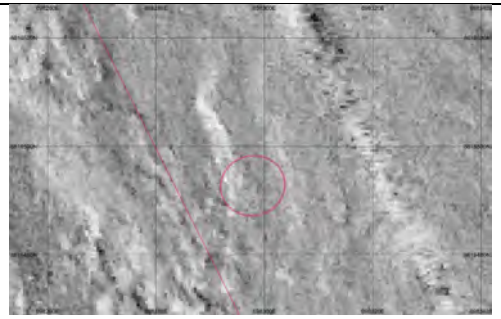
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	149	691 670.76	8 626 677.01			No	Unknown, may be related to pipeline or another cultural feature.	Total length: 258m Total Width: 19m Ind. Diameter: 5m	19m	200m
A	164*	693 038.56	8 625 231.53			Yes, MA_002	Possible 1879 subsea cable remains or anti-sub defences/ net. Likely connected to Target ID: 167 FUGRO ID: NCL_SC_026	Total length: 209m Width: 2m	16m	30m
A	166*	693 399.74	8 624 898.55			No	Series of high relief single objects with connecting line. Possible 1879 subsea cable remains or anti-sub defences. FUGRO ID: NCL_SC_017, 018, 019	Length: 73m Width: 5m	21m	41m

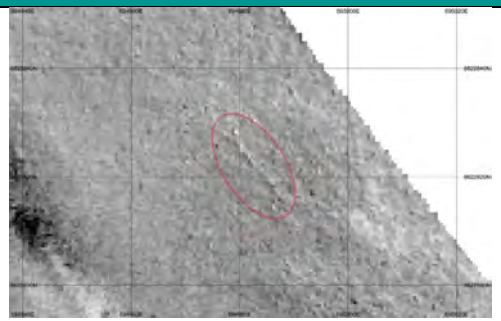
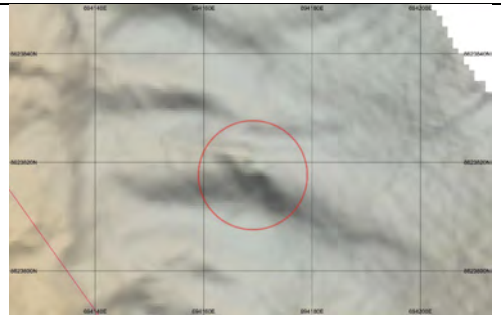
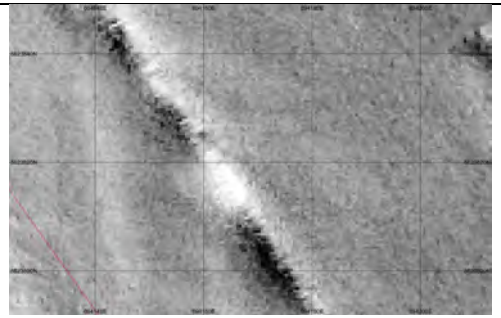
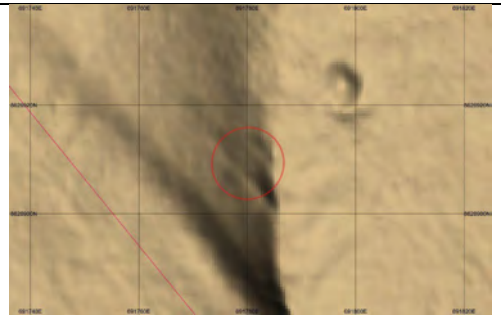
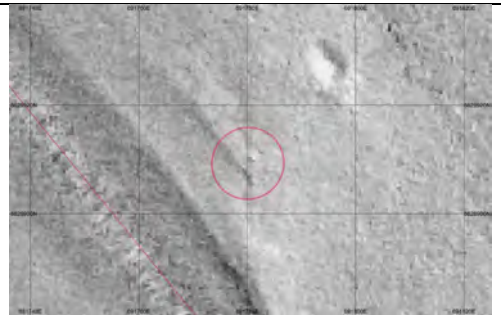
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	167*	693 085.69	8 625 121.75			No	Series of high relief single objects with connecting line. Possible 1879 subsea cable remains or anti-sub defences. Likely connected to Target ID: 164	Length: 3m Width: 3m	16m	76m
A	191	696 438.36	8 620 800.13	N/A		No	Single object of high relief. Possible small boat.	Length: 8m Width: 3m	19m	73m
A	210	701 140.90	8 613 958.61			No	Possible aircraft wreck or natural feature.	Length: 12m Width: 7m	17m	389m

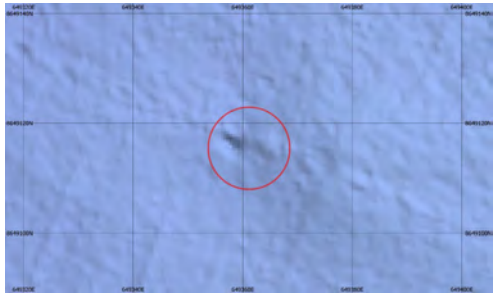
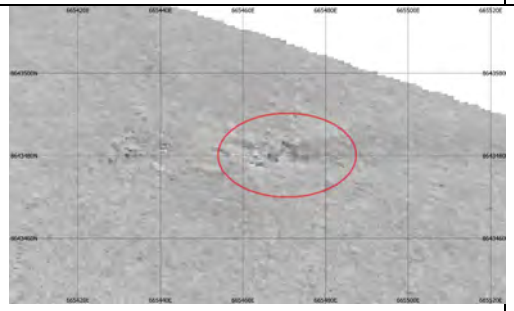
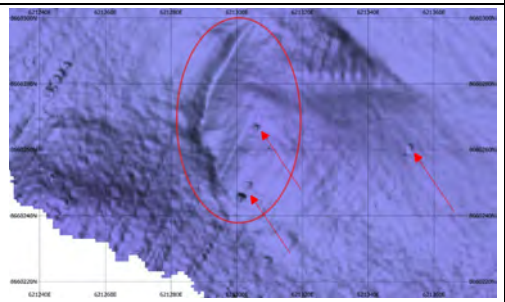
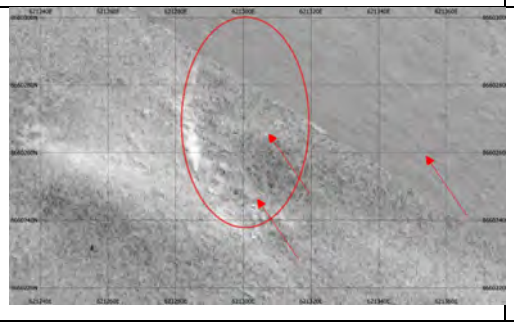
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	234	647 746.21	8 649 692.16			No	Single mound, indicating lone discarded object.	Length: 5m Width: 4m	43m	173m
A	238	696 581.70	8 620 537.67	N/A		No	Possible scattered debris.	Length: 70m Width: 10m	21m	78m
A	239	697 710.77	8 617 774.90	N/A		Yes, MA_001	USAT *Mauna Loa*	Length: 124.97m Width: 16.46m	19m	90m

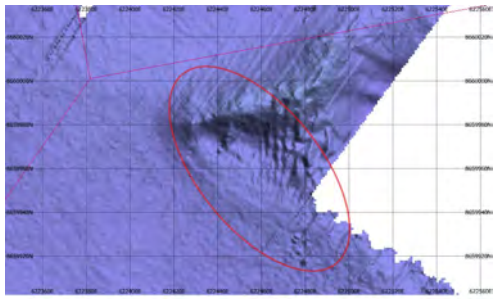
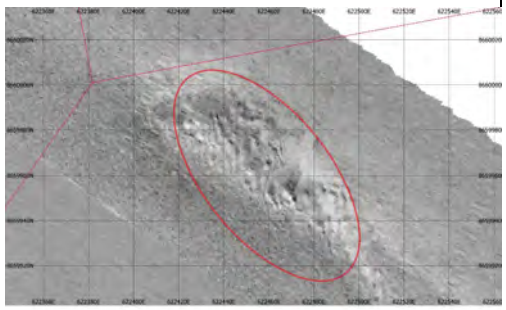
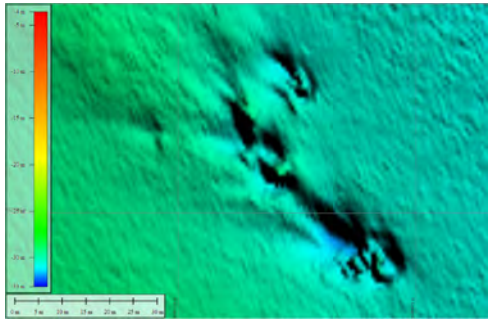
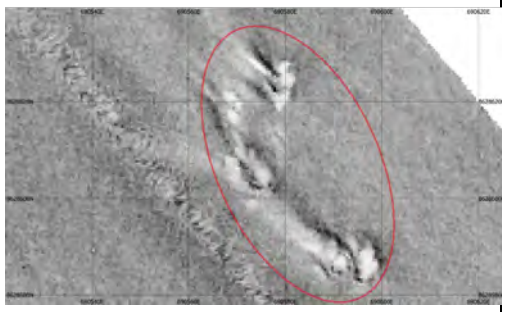
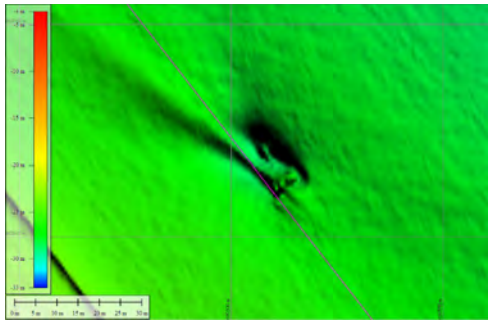
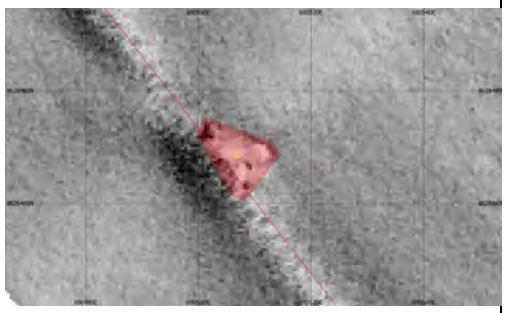
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	240	691 578.22	8 626 925.25			No	Possible mooring block for anti-submarine defences	Length: 4m Width: 2m	16m	122m
A	242	691 589.94	8 626 799.20			No	Steel wire rope and chain associated with anti-submarine defences. (boom net), UXO including mechanical fuses and fuse cones. (See Section 6.4)	Length: 23m Width: 13m	17m	186m
A	243	693 188.00	8 624 746.00	N/A		No	Possible mooring block related to anti-submarine defences.	Length: 2m Width: 2m	15m	216m

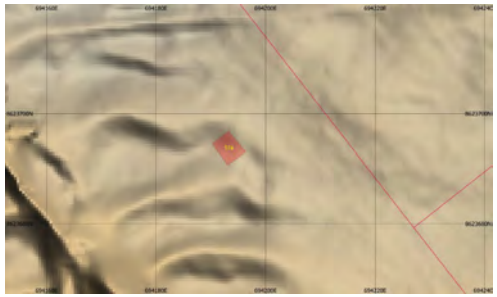
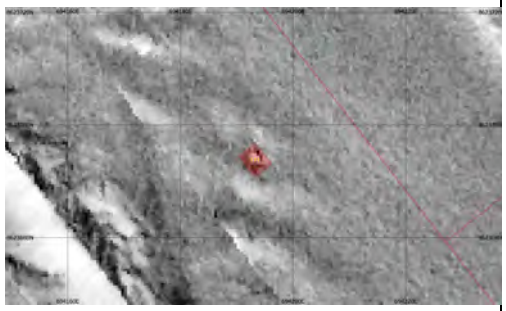
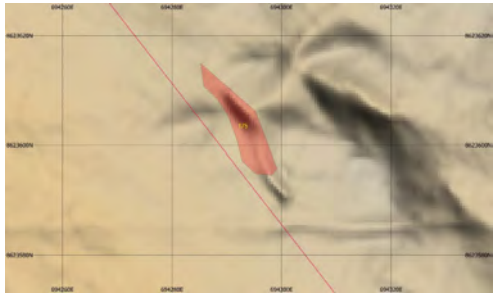
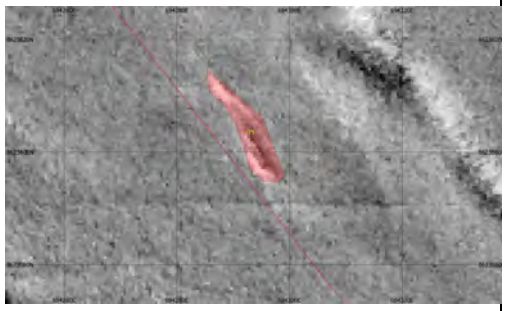
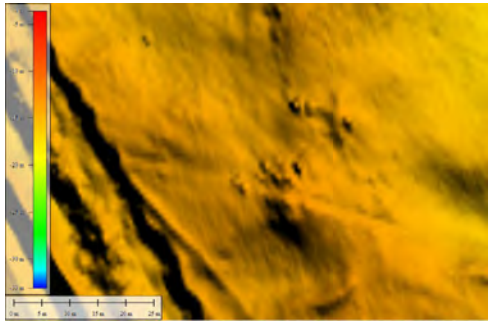
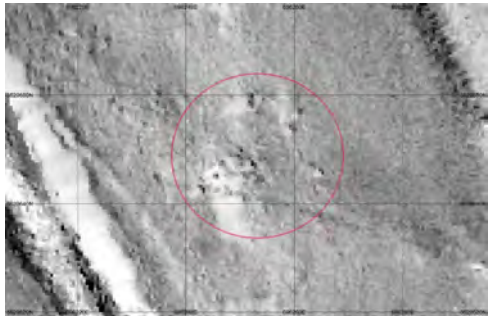
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	244*	693 196.00	8 625 167.00			No	Series of high relief single objects with connecting line. Possible 1879 subsea cable remains or anti-sub defences. FUGRO ID: NCL_SC_022, 023, 024, 025	Total Length: 120m Width: 5m (at arrow)	22m	50m
C	245*	693 161.00	8 625 121.00			Yes, MA_012	Rocks	Length: 38m Width: 22m	16m	0m
C	246*	693 260.86	8 625 002.53			Yes, MA_011	Boulders FUGRO ID: NCL_SC_021	Length: 31m Width: 15m	23m	0m

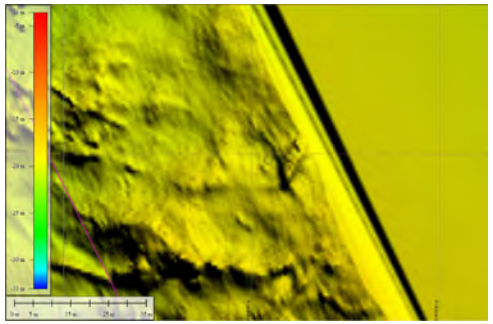
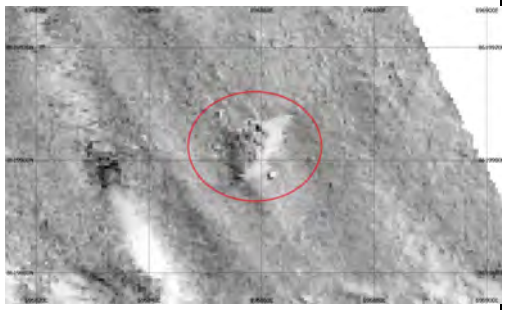
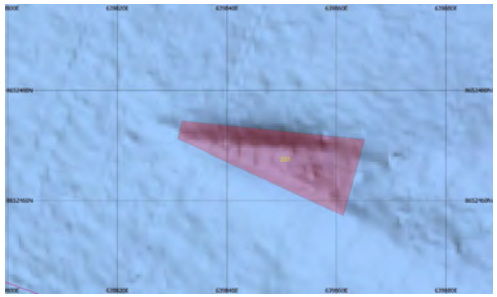
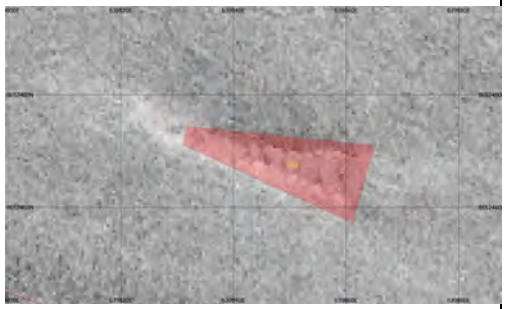
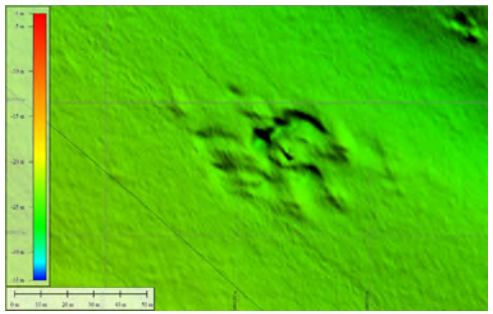
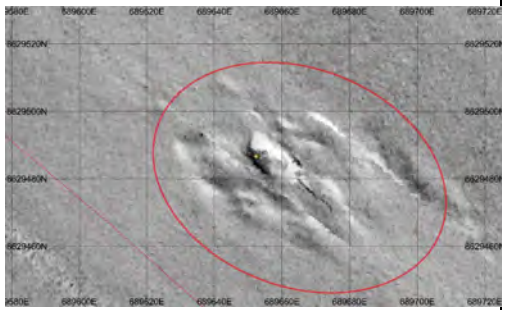
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	247*	693 281.16	8 624 939.53			Yes, MA_003	No cultural material found	Length: 18m Width: 6m	23m	23m
A	248	693 131.66	8 624 925.53			Yes, MA_028	Debris scatter, or possible anti-submarine net remains	Length: var. Width: var.	16m	150m
B	NCL_SC_002*	698 297.94	8 616 489.78			No	Single isolated object, possible debris or natural feature	Length: 1m Width: 0.4m	17m	11m

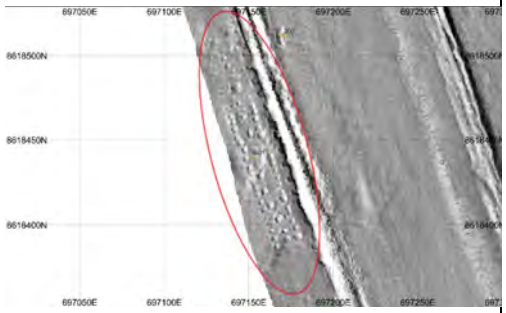
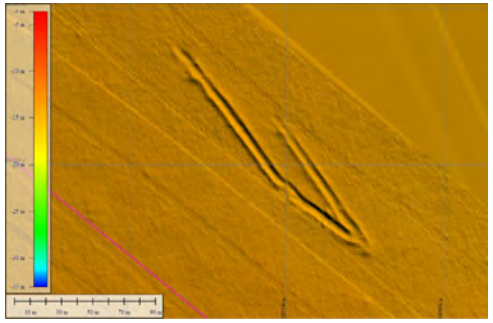
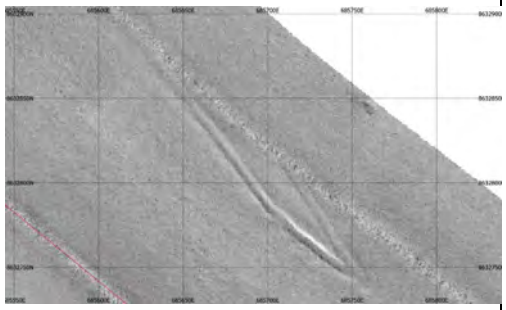
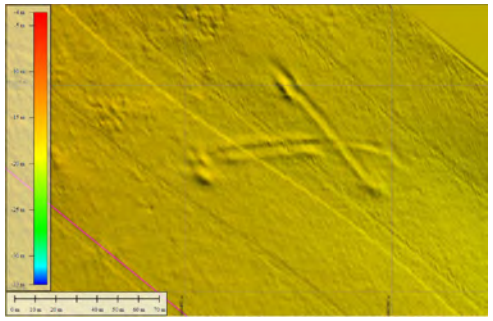
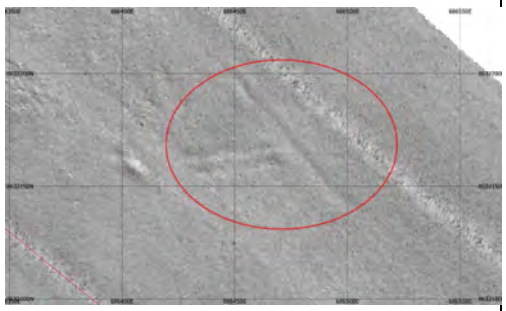
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
B	NCL_SC_010	694 982.00	8 622 822.59	N/A		No	Linear debris, likely cable remains.	Length: 17m Width: 0.5m	20m	70m
B	NCL_SC_016*	694 168.64	8 623 820.49			No	Possible cable support, or isolated non-ferrous object.	Length: 3.5m Width: 1.6m	24m	40m
B	NCL_SC_031*	691 780.61	8 626 909.95			No	Single isolated non-ferrous object, likely debris.	Length: 1.4m Width: 0.7m	16m	26m

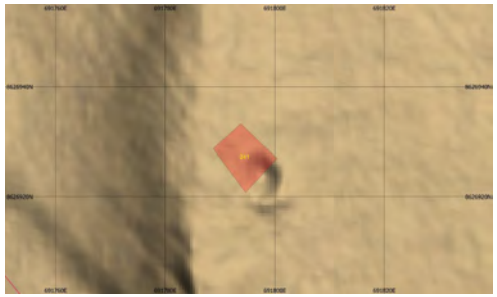
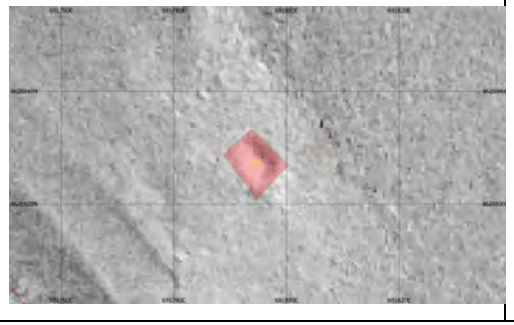
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
B	115	649 361.40	8 649 116.46			No	Shallow depressions with low relief object.	Length: 8m Width: 4m	44m	86m
B	130	665 465.07	8 643 481.67	N/A		No	Possible debris scatter.	Length: 18m Width: 8m	29m	208m
B	135	621 286.34	8 660 259.37			No	Likely natural feature, closest proximity target to I-124	Length: 62m Width: 58m	48m	143m

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
B	136	622 455.26	8 659 969.89			No	Possible debris scatter or natural feature.	Length: 98m Width: 32m	49m	214m
B	141	690 574.96	8 628 606.67			No	Debris or rocks FUGRO ID: NCL_SC_043, 044, 045, 046	Length: 53m Width: 20m	30m	137m
C	142*	690 511.00	8 628 469.00			No	Boulders FUGRO ID: NCL_SC_042	Length: 15m Width: 12m	29m	0m

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
A	174*	694 194.43	8 623 696.01			Possibly associated with MA_010	Windlass or winch from vessel with rope FUGRO ID: NCL_SC_013	Length: 5m Width: 4m	24m	16m
C	175*	694 295.02	8 623 601.00			Possibly associated with MA_009	Natural ridge	Length: 24m Width: 5m	24m	2m
B	192	696 253.89	8 620 643.48			No	Possible debris	Length: 24m Width: 22m	14m	147m

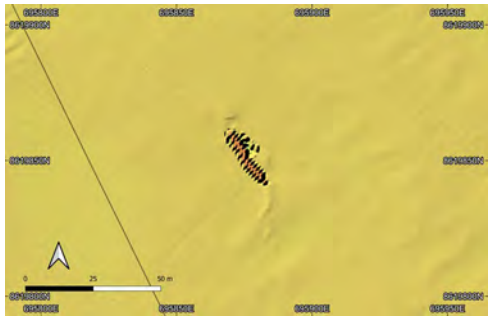
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
B	196	696 859.94	8 619 902.39			No	Debris or rocks	Length: 9m Width: 6m	19m	53m
B	233*	639 844.98	8 652 470.81			No	Triangular depression, Likely natural feature.	Length: 39m Width: 8m	41m	34m
C	140	689 653.25	8 629 488.15			No	Darwin Harbour Lateral Buoy 5 mooring FUGRO ID: NCL_SC_047, 050	Length: 89m Width: 42m	24m	28m

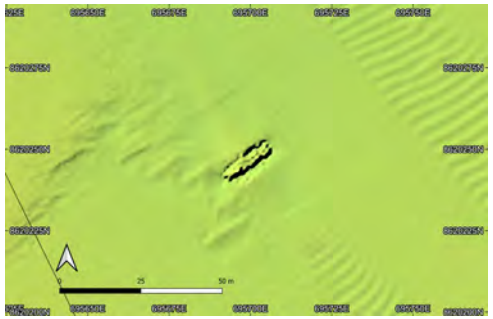
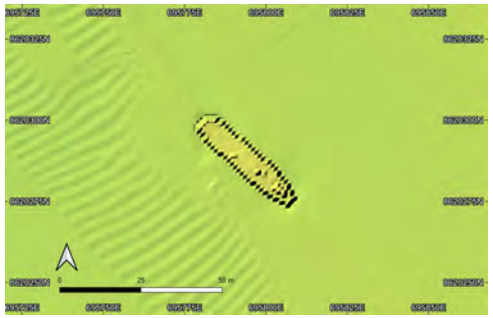
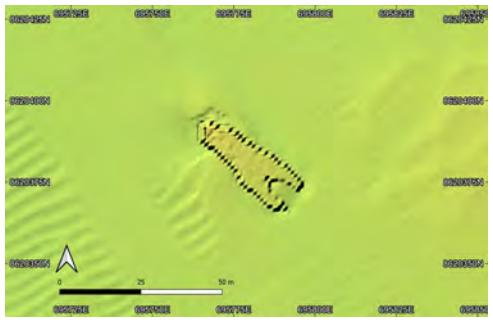
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
C	201	697 153.77	8 618 442.04	N/A		No	Spud marks from BU pipeline construction	Total length: 129m Total Width: 19m Ind. Diameter: 4m	16m	188m
C	235	685 698.53	8 632 788.44			No	Anchor drag	Length: 170m Width: 6m	14m	95m
C	236	686 460.34	8 632 164.86			No	Anchor drag	Length: 89m Width: 7m	18m	72m

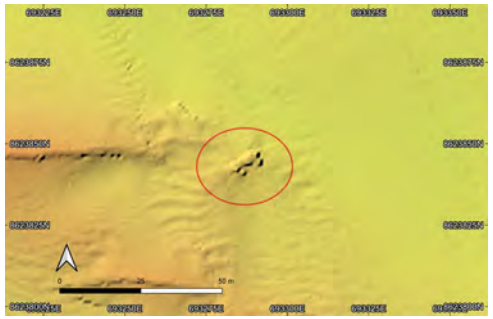
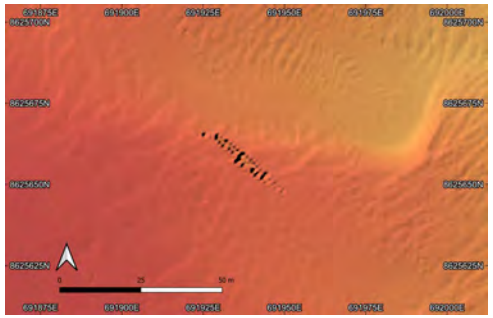
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from pipeline
		Easting	Northing							
C	241*	691 796.25	8 626 930.15			No	Depression on seabed, possibly cultural, anchor drag. FUGRO ID: NCL_SC_032	Length: 9m Width: 8m	20m	46m

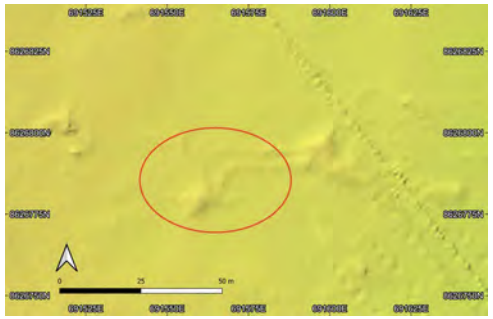
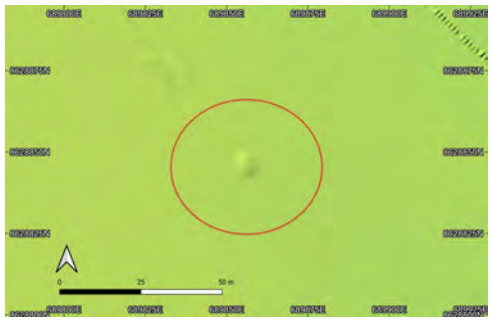
6.3.2 *Targets within anchoring corridor*

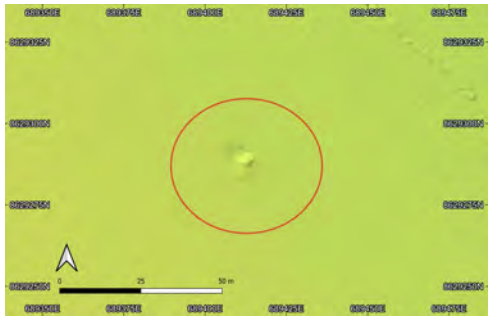
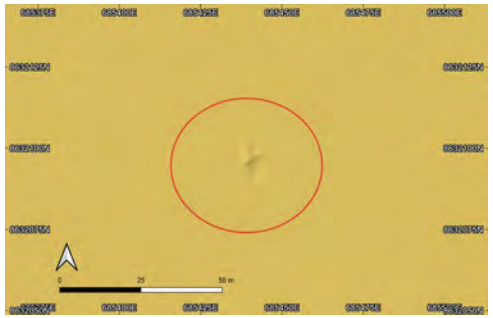
Table 9: Targets within anchoring corridor identified from Darwin Harbour public MBES data.

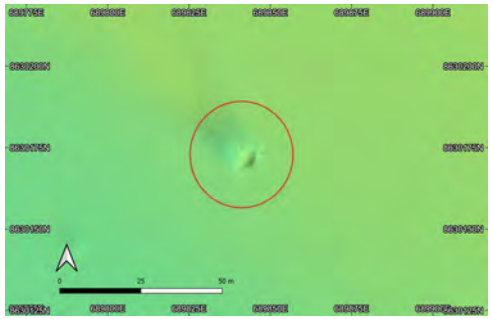
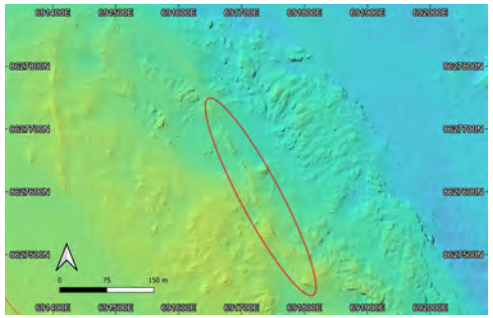
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	500	697,615.17	8,618,840.23		USAT Meigs	121.00	20.00	3.30	20	369
A	501	695,875.84	8,619,850.01		Medkhanun 3	25.00	8.00	7.00	19	847

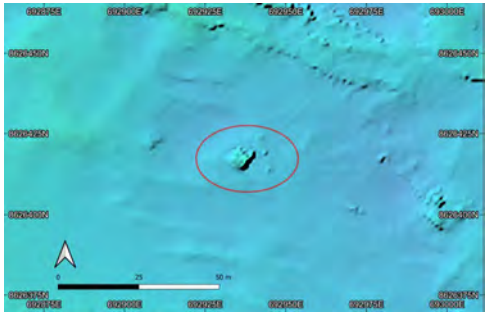
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	502	695,698.81	8,620,246.53		Ham Luong	18.00	5.00	3.00	25	832
A	503	695,794.02	8,620,287.72		Song Saigon	40.00	10.00	5.00	24	728
A	504	695,778.93	8,620,381.31		John Holland Barge	38.00	15.00	5.00	25	700

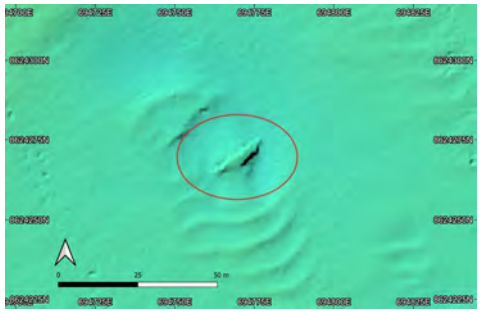
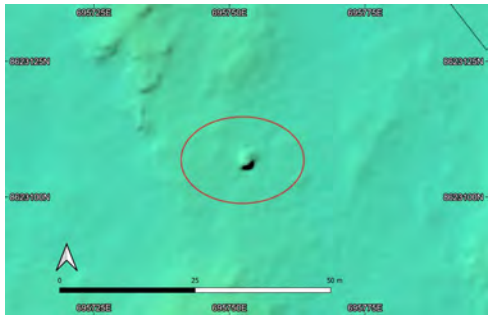
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	505	693,287.42	8,623,844.84		Mandorah Queen	12.00	5.00	2.00	20	683
A	506	691,938.35	8,625,657.51		NR Diemen	29.00	5.00	0.00	8	642
A	573	692,508.78	8,625,489.01		Debris	26.00	15.00	0.50	17	295

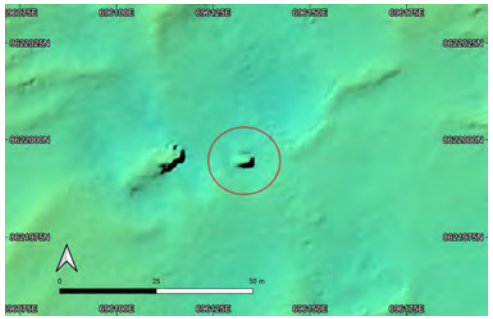
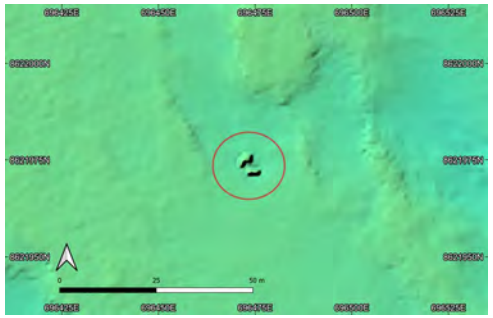
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	574	691,574.41	8,626,791.47		WWII anti-sub boom net	41.00	21.00	1.00	21	209
A	575	691,518.71	8,626,801.77		Debris	10.00	6.00	0.75	20	245
B	576	689,856.12	8,628,847.08		Mound	7.00	6.50	0.40	25	268

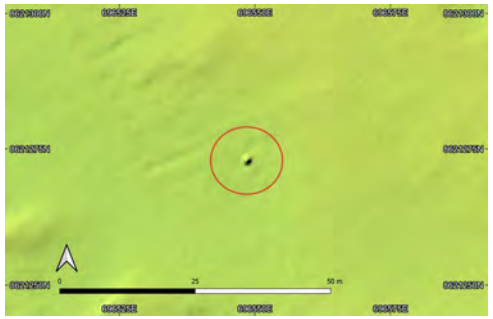
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	577	689,412.76	8,629,288.62		Isolated object	4.00	4.50	0.50	24	263
B	578	685,439.11	8,632,096.37		Mound associated with trawl scar	8.00	4.50	0.40	17	603
A	579	689,314.84	8,630,473.13		Debris	20.00	9.00	1.30	31	592

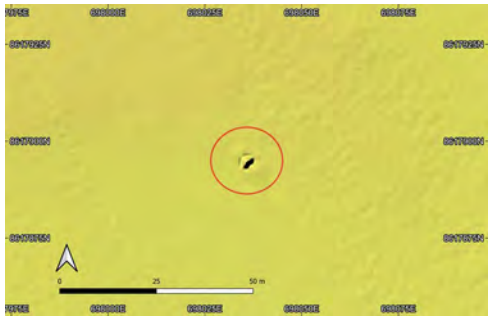
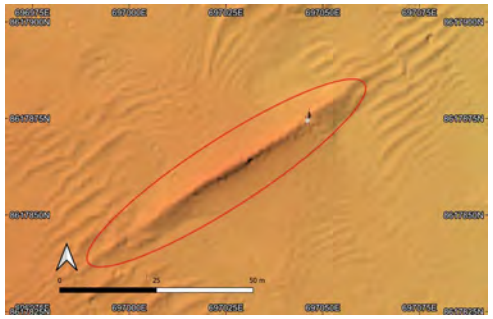
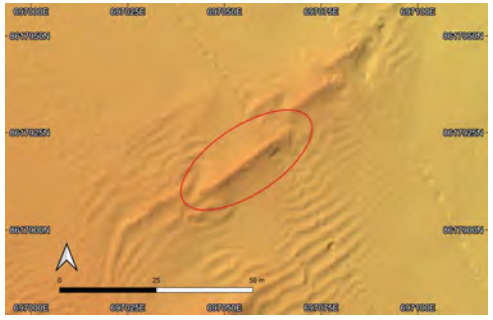
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	580	689,842.70	8,630,171.05		Mound	5.00	4.00	1.50	30	691
A	581	691,692.88	8,627,659.36		Possible cable	312.00	2.50	1.40	31	431
A	583	692,918.80	8,626,550.93		Linear debris	11.00	2.00	1.50	39	682

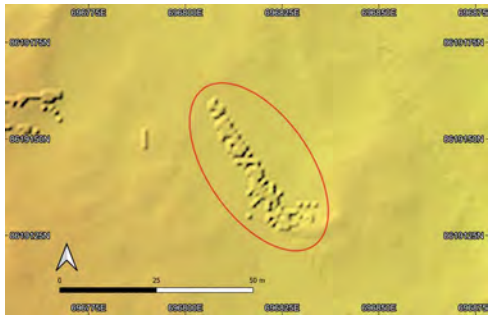
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	584	692,936.90	8,626,417.56		Debris or boulder	7.00	6.00	3.50	39	613
A	588	693,982.49	8,624,331.38		Debris	8.00	4.00	2.50	35	165
A	585	694,508.35	8,624,088.70		Debris	9.00	3.00	0.50	32	472

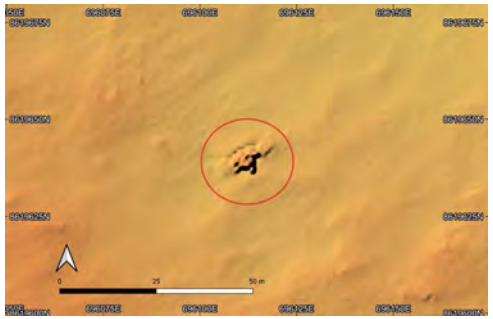
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	586	694,770.88	8,624,269.65		Possible small boat or natural feature	17.00	4.00	1.25	35	791
A	587	695,753.15	8,623,106.77		Mooring block	3.00	2.50	0.80	33	852
A	589	696,110.51	8,621,995.74		Debris	17.00	7.00	2.50	33	452

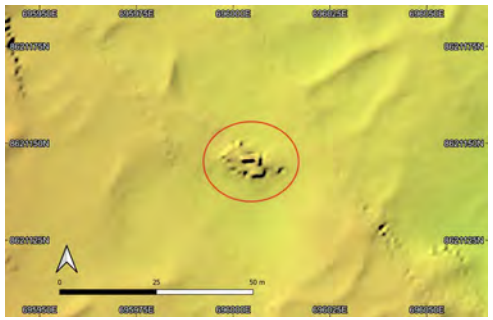
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	590	696,133.59	8,621,994.69		Debris	4.50	2.50	2.00	33	470
A	591	696,472.78	8,621,975.02		Debris	6.40	6.20	1.50	32	727
A	592	696,535.45	8,621,187.11		Debris	8.50	2.70	1.30	25	345

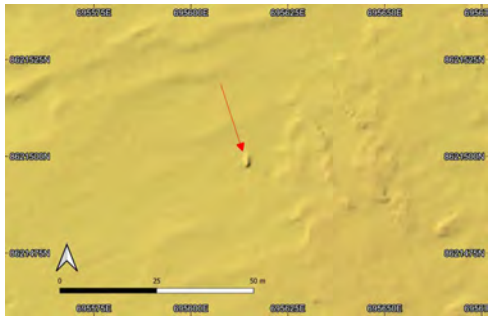
Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	593	696,548.46	8,621,272.90		Mooring block	1.40	1.40	0.75	25	399
A	594	697,090.00	8,620,464.24		Debris	3.50	3.00	1.75	25	513
A	595	697,563.09	8,620,256.32		Debris	6.50	4.20	1.75	32	845

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	597	698,035.82	8,617,894.98		Debris	3.00	3.00	2.00	20	443
B	598	697,030.36	8,617,864.23		Linear feature	59.00	2.00	0.75	12	504
B	599	697,055.70	8,617,918.12		Linear feature	24.00	2.00	0.75	13	462

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	600	697,036.34	8,618,057.64		Linear feature	33.00	2.00	1.00	16	434
A	601	696,815.85	8,619,144.52		Debris	40.00	8.00	0.50	19	286
A	602	696,751.52	8,619,156.36		Debris	24.00	11.00	0.75	16	343

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
A	603	696,112.03	8,619,639.40		Debris	8.00	6.60	3.00	14	729
B	604	696,043.52	8,619,624.92		Linear feature, log	18.70	2.40	1.00	13	797
B	605	696,000.91	8,619,629.09		Linear feature, log	15.80	2.40	0.50	13	833

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	606	696,032.94	8,619,598.74		Linear feature, log	13.00	2.40	0.75	13	818
B	607	696,362.60	8,619,654.65		Debris	7.00	6.50	1.00	12	497
A	609	696,003.49	8,621,145.27		Debris	16.00	7.50	3.00	21	132

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Image MB	Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing			Length	Width	Height		
B	610	695,614.51	8,621,498.95		Isolated object	3.30	1.50	0.60	18	244
A	611	693,064.64	8,624,298.00		Mooring block	1.70	1.70	0.50	17	599
A	612	693,132.32	8,624,265.69		Debris	3.00	2.50	0.90	18	568

6.3.3 *WWII anti-submarine net moorings*

Targets located between KP 107 and 108 have been identified as the remains of World War II anti-submarine net moorings. Targets listed in Table 10 omit geophysical survey images, as well as target dimensions, because all targets are highly uniform in size and shape.

Table 10: Location of potential WWII anti-submarine boom net moorings, identified from Fugro survey data and Darwin Harbour public MBES data.

ID		Datum: GDA94 CRM: UTM Zone 52S		Distance from GEP (m)
		Easting	Northing	
A	620	692,571.44	8,624,809.47	663
A	621	692,539.74	8,624,860.74	656
A	622	692,523.80	8,624,892.44	649
A	623	692,599.70	8,624,754.58	674
A	624	692,709.75	8,624,594.89	685
A	625	692,769.99	8,624,467.63	716
A	626	692,749.61	8,624,525.87	696
A	627	692,726.33	8,624,548.70	700
A	628	692,147.90	8,624,971.06	898
A	629	692,431.95	8,624,717.81	829
A	630	692,412.02	8,624,771.61	812
A	631	692,453.33	8,624,625.24	869
A	632	692,922.97	8,624,532.76	556
A	633	692,914.46	8,624,593.08	525
A	634	692,897.79	8,624,648.33	504
A	635	692,876.05	8,624,702.14	488
A	636	692,763.55	8,624,903.58	453
A	637	692,729.14	8,624,950.23	452
A	638	692,816.54	8,624,826.14	459
A	639	693,066.90	8,624,638.82	377
A	640	693,040.27	8,624,691.00	365
A	641	693,020.88	8,624,746.07	347
A	642	692,944.62	8,625,014.99	242
A	643	692,919.53	8,625,081.20	221
A	644	692,908.66	8,625,150.86	187
A	645	692,905.94	8,625,190.98	164
A	646	693,039.04	8,625,225.45	38
A	647	693,058.79	8,625,182.69	49
A	648	693,076.54	8,625,127.44	69

ID		Datum: GDA94 CRM: UTM Zone 52S		Distance from GEP (m)
		Easting	Northing	
A	649	693,093.03	8,625,071.10	90
A	650	693,205.80	8,624,728.36	213
A	651	693,234.87	8,624,680.26	222
A	652	693,144.21	8,624,841.13	191
A	653	693,182.07	8,624,784.25	196
A	654	693,311.23	8,624,817.58	75
A	655	693,293.93	8,624,874.10	53
A	656	693,197.83	8,625,161.77	48
A	657	693,162.23	8,625,272.64	88
A	658	693,173.46	8,625,217.02	63
A	659	693,400.45	8,624,893.93	42
A	660	693,420.92	8,624,841.76	24
A	661	693,376.72	8,624,944.02	56
A	662	693,282.43	8,625,202.62	140
A	663	693,307.79	8,625,145.38	125
A	664	693,254.26	8,625,282.33	167
A	665	693,362.50	8,625,014.22	88
A	666	693,460.95	8,625,089.13	211
A	667	693,555.33	8,624,959.96	203
A	668	693,650.62	8,624,848.92	204
A	669	693,506.97	8,624,814.32	72
A	670	693,465.48	8,624,923.37	111
A	671	693,643.69	8,624,929.98	251
A	672	693,469.78	8,625,242.93	313
A	673	693,711.60	8,625,070.97	394
A	674	694,135.50	8,625,135.19	759
A	675	694,161.68	8,625,283.10	875
A	676	694,183.69	8,625,228.03	856
A	677	694,250.36	8,625,094.43	821
A	678	693,923.28	8,625,184.46	629
A	679	693,952.90	8,625,141.07	624
A	680	693,970.93	8,625,083.92	601
A	681	693,751.64	8,625,475.17	678
A	682	693,775.01	8,625,422.23	664

ID		Datum: GDA94 CRM: UTM Zone 52S		Distance from GEP (m)
		Easting	Northing	
A	683	693,794.64	8,625,355.29	638
A	684	693,902.95	8,625,554.38	846
A	685	694,101.63	8,625,224.18	791
A	686	693,979.35	8,625,516.11	883
A	687	693,951.72	8,625,500.98	852
A	688	693,595.12	8,625,397.09	506
A	689	693,625.83	8,625,262.22	448
A	690	693,861.92	8,624,914.00	408
A	691	694,235.64	8,625,020.33	763
A	692	694,004.85	8,624,910.74	515
A	693	693,790.27	8,625,076.31	458
A	694	692,680.70	8,625,066.80	418
A	695	692,486.05	8,624,972.60	630
A	696	692,274.19	8,624,850.32	872
A	697	692,370.93	8,624,932.20	746
A	698	692,376.54	8,624,652.46	913
A	699	693,479.77	8,625,162.13	271
A	700	693,373.52	8,625,219.83	223
A	701	692,476.81	8,624,552.19	895
A	702	692,545.01	8,624,451.33	903
A	703	692,536.68	8,624,530.67	861
A	704	692,512.14	8,624,583.21	848
A	705	692,731.65	8,624,460.66	750
A	706	693,612.40	8,625,501.30	584
A	707	693,639.40	8,625,450.30	414
A	708	693,667.30	8,625,396.10	435
A	709	693,801.20	8,625,027.90	562
A	710	693,812.30	8,624,981.60	576

6.4 Summary of Fugro Geophysical Survey Data Review

In total, 39 potentially cultural anomalies were identified from a review of the Fugro geophysical data, including three magnetic anomalies with no sonar or multibeam presence (see Figure 43). Of these 39, 21 were classed as category A, 15 as category B, and 3 as category C, with the three magnetic anomalies unranked. The distribution of targets increases with the approach into Darwin Harbour, with the highest concentration between KP 101 and KP 116 (see Figure 43).

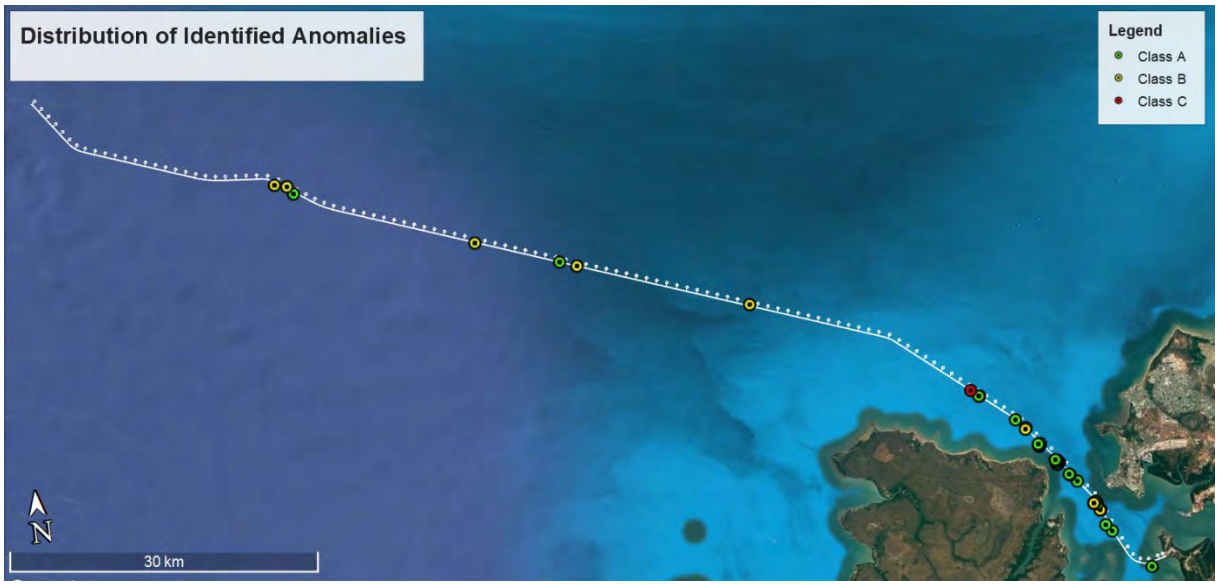


Figure 43: Overview of identified geophysical survey anomalies, colour coded by category type.

Figure 44: Identified geophysical anomalies within Darwin Harbour and approach, approx. KP 93 to 122 (terminus).

6.4.1 *Clusters of geophysical anomalies*

This section reviews five clusters of potential cultural heritage anomalies, and include mostly Class A anomalies, associated Class B anomalies, and associated magnetometer strikes.

6.4.1.1 Cluster 1: KP 25 – 28 (anomalies near I-124)

A cluster of targets was identified between KP 22-28 in the section of the proposed pipeline route that curves around the protected zone of the wreck of the Japanese submarine I-124 (see Figure 45). While the location of the wreck is well documented, and no evidence of I-124 was identified from the geophysical survey, the existence of geophysical anomalies in the area indicates a small likelihood that cultural material associated with the wreck may be present in the area. Of the three identified anomalies between KP 25 and 28, two are ranked in category B, and one is ranked category A. The category B targets cannot be positively identified as cultural or natural based on the available geophysical data. The single category A target, anomaly 112, appears to be a single object of relatively high relief, measuring approximately 8m by 6m. It is located over 2.5 km from the centre of the I-124 protected zone, indicating a very remote chance that it is associated with the Japanese submarine.

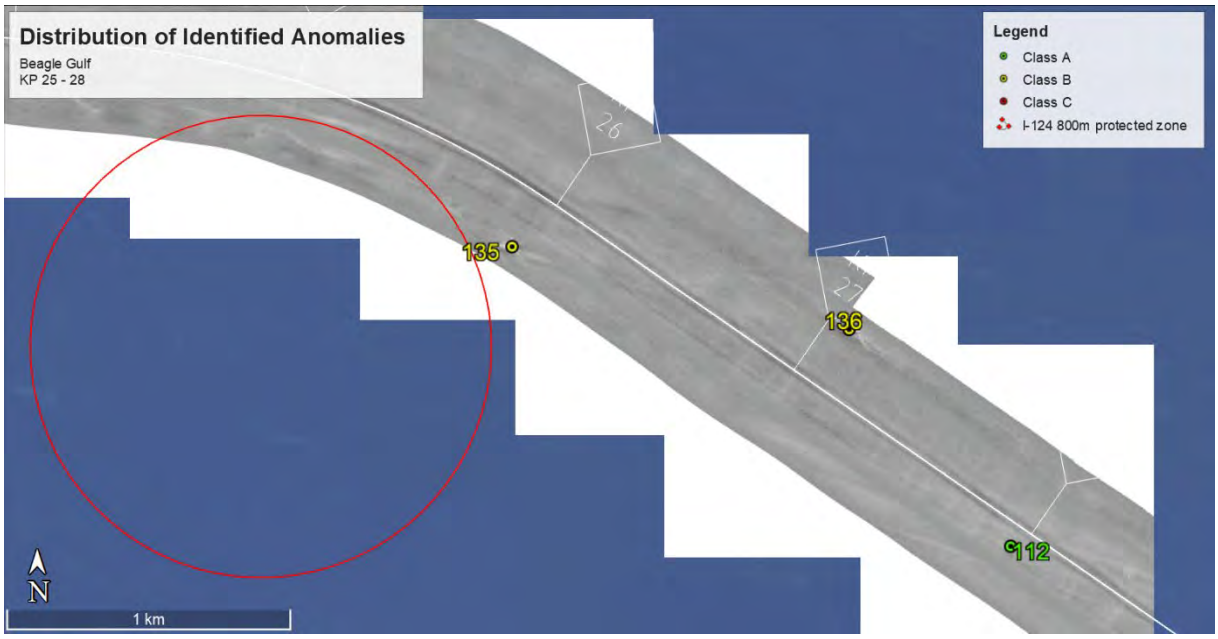


Figure 45: Cluster of geophysical survey anomalies between KP 25 and KP 28. 800m protection zone for I-124 indicated by red circle.

6.4.1.2 Cluster 2: KP 104 – 106 (anti-submarine defences/indicator loop remains)

A second cluster of targets was located between KP 104 and 106. Four geophysical anomalies were identified by SSS and MBES at KP105, three were categorised as A and one as category B.

Previous surveys by CA identified the remains of anti-submarine netting and mechanical time fuses and fuse cones located at 691614 m E and 8626792 m N (see Figure 48 and Figure 49). These remains, labelled Contact 2 in the CA report, are located within the immediate vicinity of anomaly 242, approximately 25m away at a bearing of 286 degrees:

> *Contact 2 consists of a large collection of steel wire rope and chain associated with the WWII anti-submarine boom net* [Figure 48]*. Also located were the remains of at least 4 boom net float buoys and what appear to be supporting frames for the boom net. On the south eastern side of the site is a collection of UXO consisting of mechanical time fuses and fuse cones* [Figure 49]*. These fuses and cones are most likely from artillery shells. A total of 15 fuses were identified but it is likely that more are buried beneath the sediment. The fuses and use cones were most likely stored together in a box but this has deteriorated and spilt the fuses and cones onto the sea floor. Contact 2 covers an area of approximately 25 metres by 30 metres.*[107]

This survey also identified the remains of an underwater telephone cable at 692023 m E and 8626266 m N, designated Contact 3 in the same report:

> *Contact 3 consists of two lengths of underwater telephone cable. There are two parallel sections of cable that run for 30m in approximately an east west orientation* [Figure 51]*. The two cables are set 300 mm apart. The western end of the cable has been cut while the eastern end disappears into the sea floor sediment and is most likely still in situ. The cable is approximately 25 mm across and consists of a six core copper wire encased in black rubber that is then encased in grey rubber. The outside is bound in canvas with steel wire armour* [Figure 52]*. Approximately 5 metres south west of the in situ cables is a jumbled collection of broken telephone cable that appears to have been dumped in a pile.*[108]

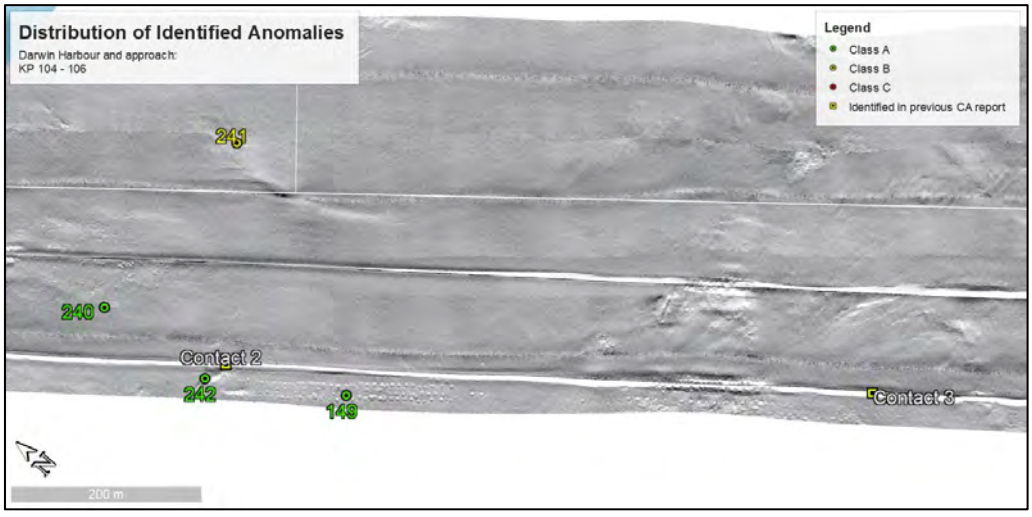


Figure 46: Cluster of geophysical anomalies from KP 104 – 106. Contact 2, associated with anti-submarine netting, and Contact 3 is indicated by yellow square.

[107] **Cosmos Archaeology, 2012,** Ichthys Project Darwin Harbour, East Arm Gas Export Pipeline: Assessment of Heritage Impact of 7 side scan targets, report prepared for Tek Ventures Pty Ltd, p.11.
[108] *Op. Cit.* **CA, 2012:**12.

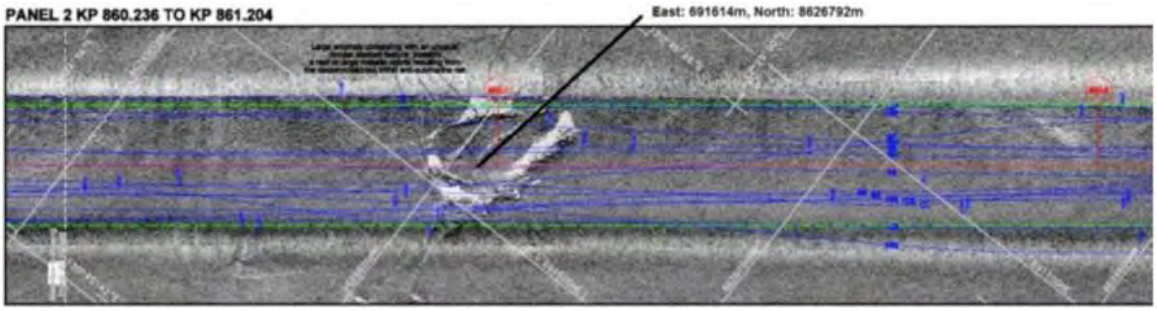


Figure 47: SSS image of Contact 2, taken during 2012 geophysical surveys for INPEX GEP. (Source: CA 2012).

Figure 48: Remains of anti-submarine netting recorded at contact 2. (Source: CA 2012).

Figure 49: Collection of mechanical time fuses and fuse cones located at Contact 2. (Source: CA 2012).

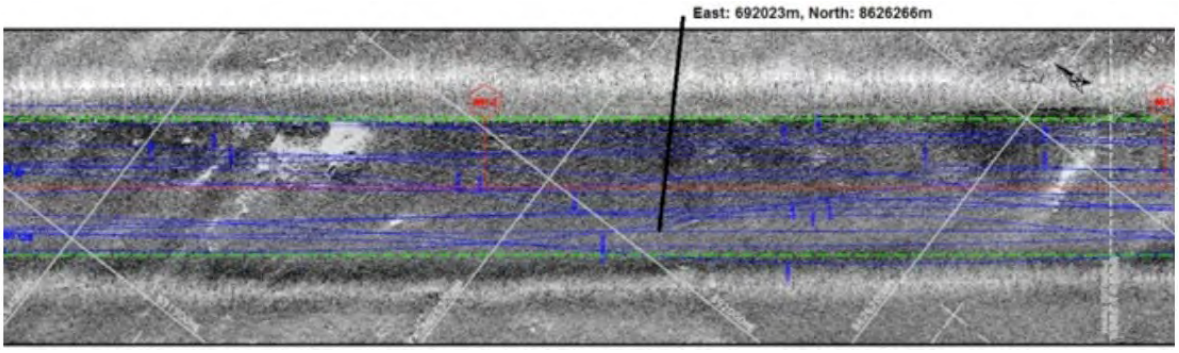


Figure 50: SSS image of Contact 3, taken during 2012 geophysical surveys for INPEX GEP. (Source: CA 2012).

Figure 51: Image of the two parallel lies of communication cable laying on sea floor. (Source: CA 2012).

Figure 52: Cross section of broken communication cable. (Source: CA 2012).

It appears from comparison of the SSS data from 2012 and 2018, that Contact 2 and Anomaly 242 are the same object, however new surveys show the INPEX GEP directly crossing the location (see Figure 47 and Figure 53). Adjacent to 242 is a series of small circular depressions, regularly spaced in several rows and uniform in size, 3-4m in diameter (Anomaly 149). The identity of these depressions is unknown, they may be related to either the anti-submarine defences or to the laying of the INPEX pipeline (see review of Anomaly 210 below). Despite the known location of ferrous material at Contact 2, no magnetometer strike was reported in the vicinity. Anomaly 240 is a high relief object rectangular in shape, potentially a mooring block related to the anti-submarine defences.

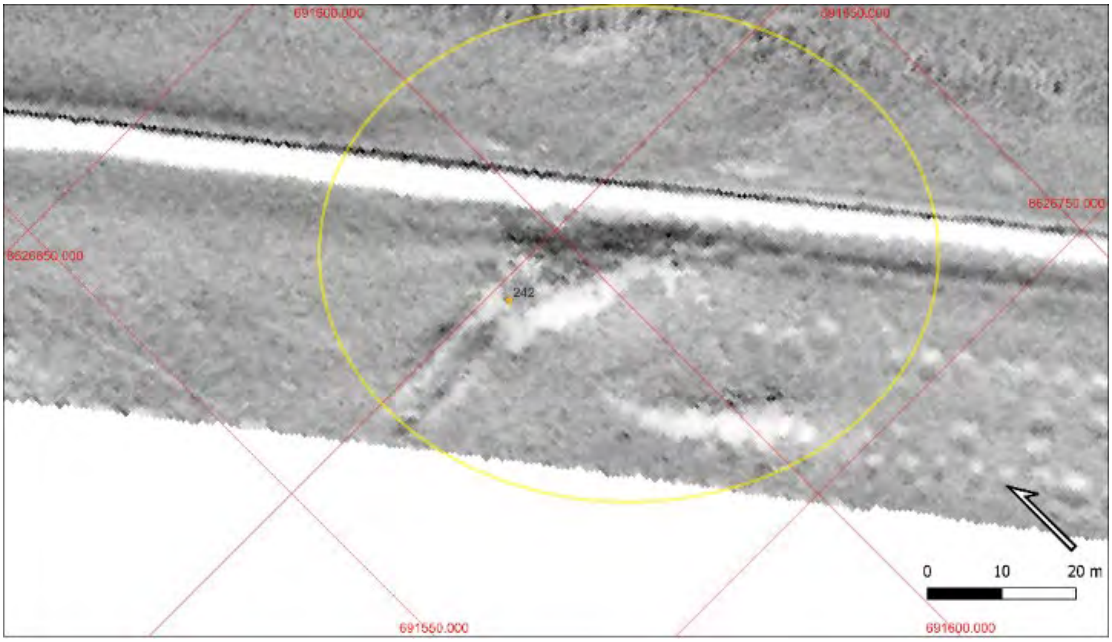


Figure 53: Anomaly 242 (circled in yellow). Note INPEX GEP crossing the target. Note circular depressions in lower right, designated Anomaly 149.

6.4.1.3 Cluster 3: KP 107-108 (anti-submarine boom net moorings)

Of particular interest is a cluster of targets located between KP 107 and 108 at a point directly between Mandorah and Dudley point at the entrance of Darwin Harbour (see Figure 54). A total of nine targets were identified within this 1km section of the proposed pipeline route, with five of those also registering as magnetometer targets, indicating the presence of ferrous materials. It was believed initially that some of these were related to WWII anti-submarine nets, identified by historical sources (see Section 4.3.3) and during CA investigations related to the INPEX project.[109] This conclusion was confirmed by ROV surveys conducted in June 2022 (see Section 7 and Annex A for summary of these surveys).

ROV surveys were conducted along three transects and identified a total of 11 moorings, including 10 large concrete clump weights and one ship's anchor (Target 164), repurposed as a mooring. These moorings were connected by heavy gauge chain and spaced roughly 60m apart. Three "trots", lines of mooring weights connected by chain, were identified within the geophysical survey corridor, and were visually inspected during ROV surveys.

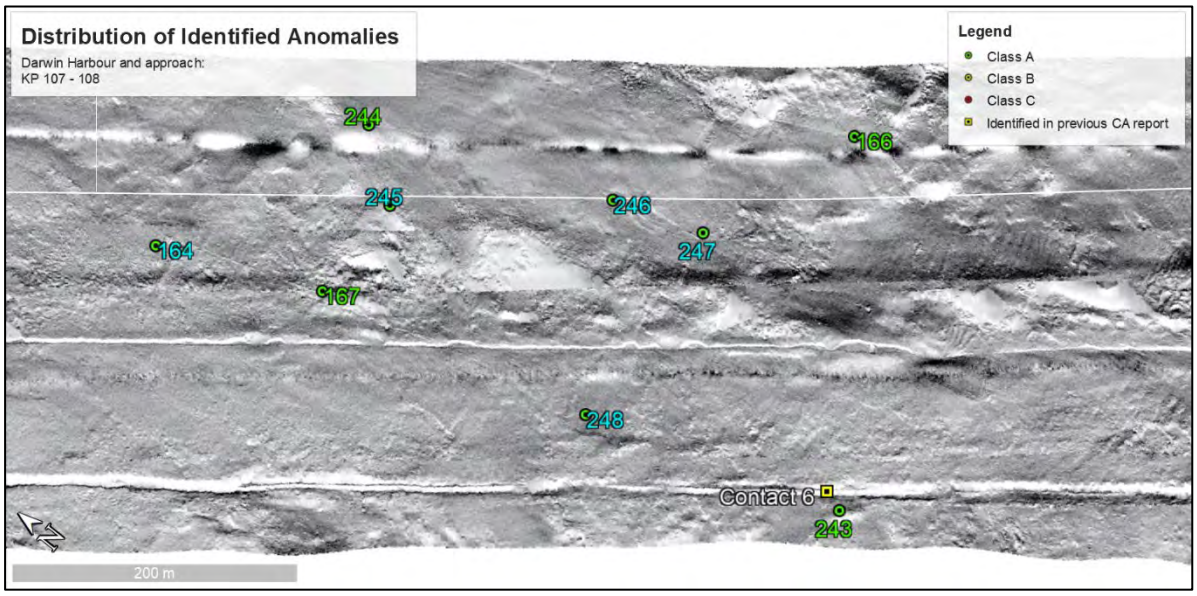


Figure 54: Identified geophysical survey anomalies between KP 107 and 108, overlaid on SSS data. Targets with blue labels are also magnetometer strikes. Contact 6 identified with yellow square.

Target 243 is approximately in the close vicinity of a mooring block (Contact 6) surveyed by CA in 2012. Contact 6, located at 693193 m E and 8624761 m N, was determined to be a structure related to an anti-submarine boom net installed during WWII (see Figure 55-56):

> *Contact 6 is a section of the mooring system for the WWII anti-submarine boom net. On the southern end of the site is a large concrete mooring block approximately 1.6 metres long, 1.4 metres wide and 0.8 metres high* [Figure 56]. *The block is sitting proud of the sea floor and there is some minor scouring around the base. On the north and the south sides of the mooring block are two large iron loops approximately 200mm from the bottom. Connected to these loops are stud link chains (350mm long, 230mm wide and 70mm across) leading off on a north and south axis* [Figure 57]. *The northern side of the chain extends for approximately 5 metres before disappearing into the sea floor. The southern side of the chain extends for approximately 7 metres before disappearing into the sediment. Although there would have originally been chain and wire rope that*

[109] *Op. Cit.* **Cosmos Archaeology, 2012**:14.

connected this mooring system to the anti-submarine net there is no indication of the chains or net left in this area. [110]

The high presence of ferrous material in this location, not associated with the existing pipelines, and sonar contacts supports the theory that most, if not all, of these targets are cultural in origin. Anomaly 245 presents as a magnetometer strike in an area of extensive rocky material. Lines seen on sonar running NW to SE are possibly remains of undersea cables installed during the 1870s (see Section 4.3.3). Note similarity in SSS image of Contact 6 (Figure 55) and Anomaly 166 (Figure 58). These two targets are approximately 250 m apart in a straight line between Mandorah and Dudley's Point.

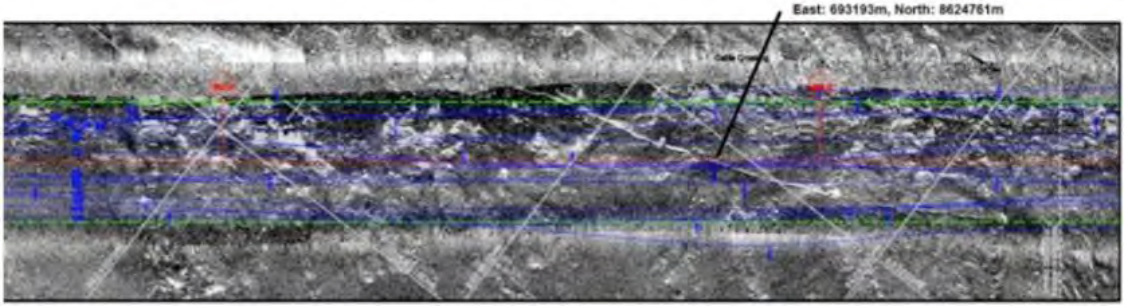


Figure 55: SSS image of Contact 6 taken during 2012 geophysical survey. Location 693193 m E and 8624761 m N.

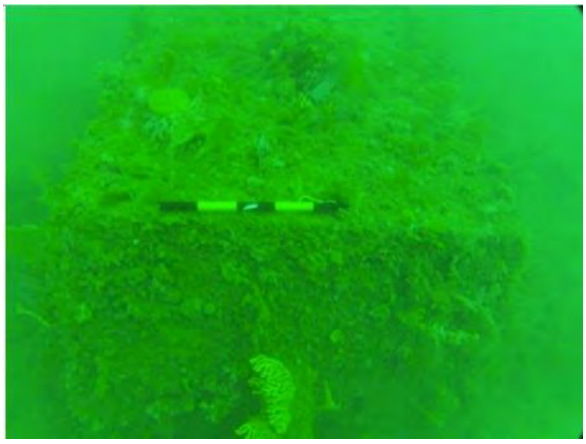


Figure 56: Concrete mooring block for anti-submarine net. (Source: CA 2012).

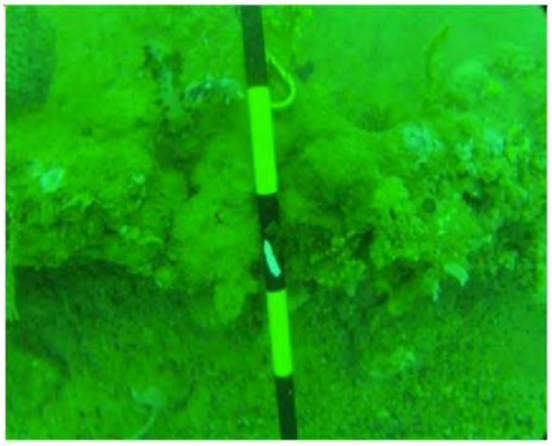


Figure 57: Detail of chain for anti-submarine netting. (Source: CA 2012).

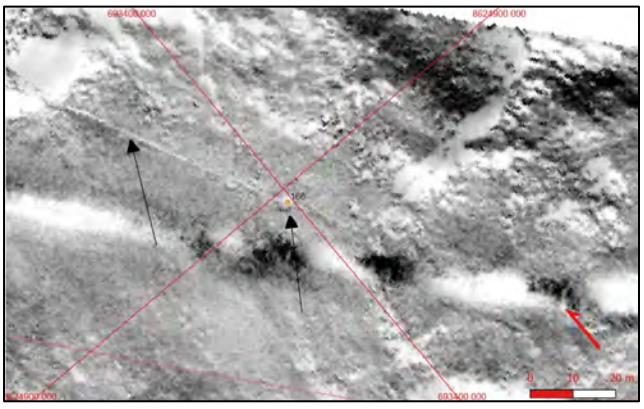


Figure 58: Geophysical anomaly 166. Black arrows pointing to mooring block and chain. DOF Subsea 2018.

[110] Op. Cit., Cosmos Archaeology, 2012, p.14.

6.4.1.4 Cluster 4: KP 108 – 110 (magnetic anomalies)

Centred at KP 109 is a cluster of magnetometer targets potentially unrelated to the existing Bayu-Undan and INPEX GEPs. Although only two geophysical anomalies were identified by review of SSS and MBES, there are an additional 10 magnetometer strikes located at least 20m away from the existing pipelines. Faint lines seen on the seabed indicate that these magnetometer strikes are possibly the remains of undersea cables, anti-submarine defences, or debris associated with the pipelines (Figure 59). Anomaly 174 was designated class A and listed as potentially associated with a magnetometer strike. ROV survey was conducted on Target 174, and identified the target as a possible winch, windlass or ship's bollard with rope still coiled around the object (see Section 7.2).

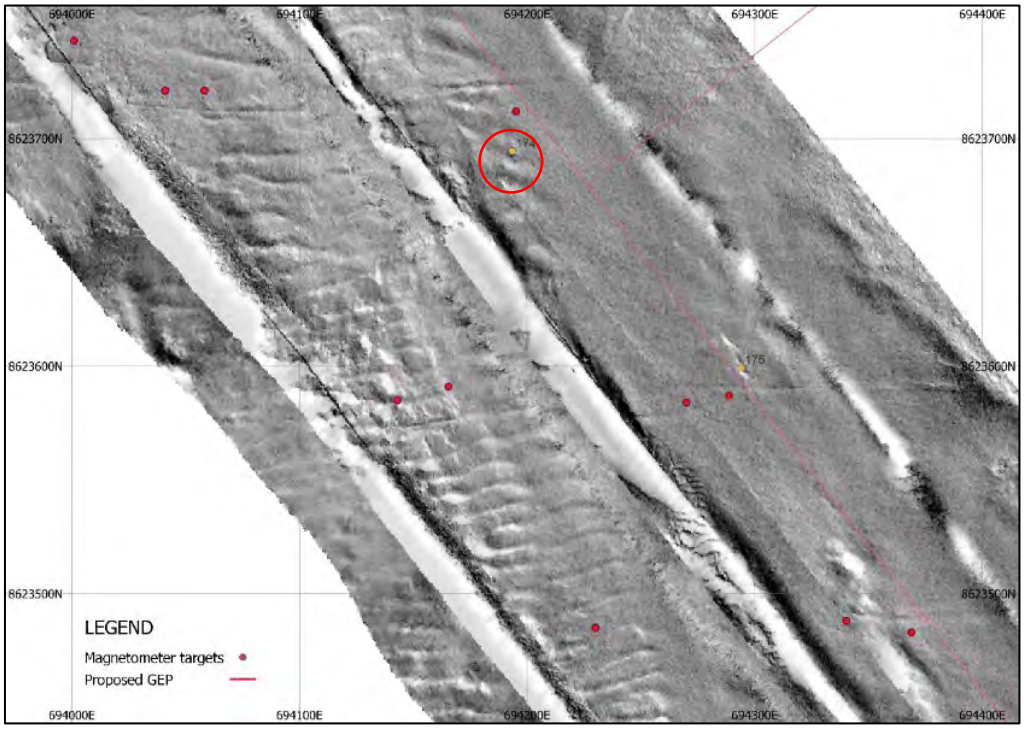


Figure 59: Location of magnetometer strikes and geophysical survey anomalies around KP 109. Note linear features along magnetometer targets. Anomaly 174 circled in red.

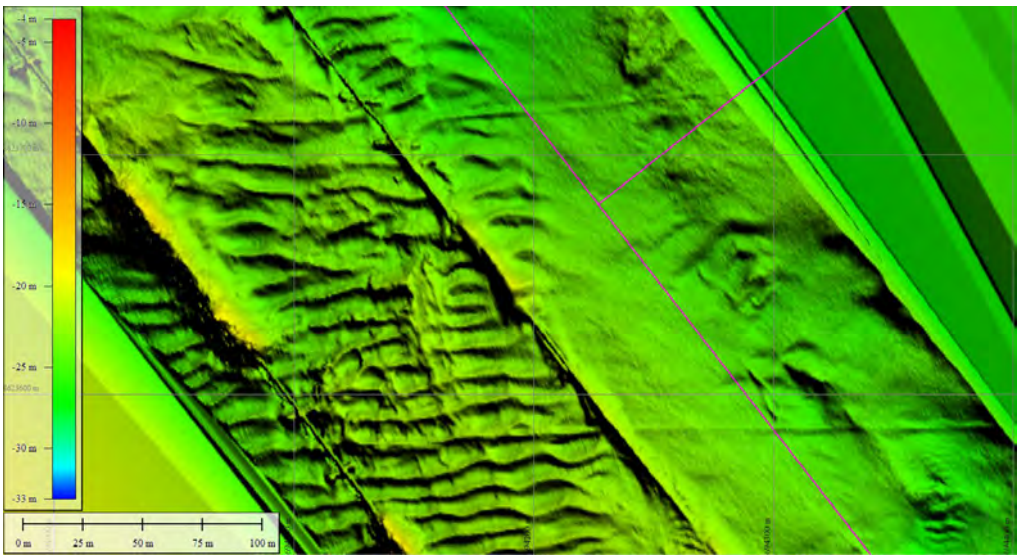


Figure 60: High resolution MBES data of same area, showing linear features near KP 109.

6.4.1.5 Cluster 5: KP 112 – 114 (debris scatters)

Around KP 113, between KP 112 and 114, is a cluster of six geophysical survey anomalies. Three are classed as category A and three are classed as category B, and no magnetometer strikes were recorded in the vicinity. One anomaly, 191, presents as a single high relief object approximately 8m in length and roughly the shape of a small boat. The remaining four targets appear to be either debris scatters or natural features.

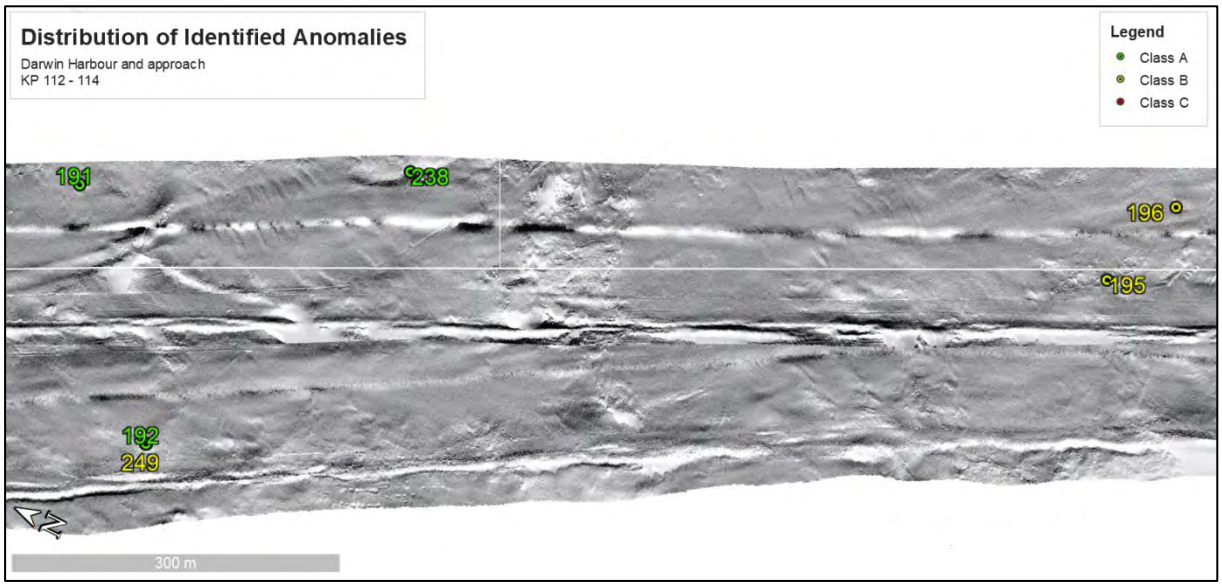


Figure 61: Cluster of geophysical survey anomalies between KP 112 and KP 114.

6.4.2 *Isolated Class A anomalies*

Anomaly 234: KP 54 – 55 (single mound, low relief)

Anomaly 234 appears to be, from SSS, a small mound of low relief, approximately 5m x 4m. It is in the general area of the known location of the 1871 subsea cable and may be related. Anomaly 234 is approximately 173m from the centreline of the proposed GEP route.

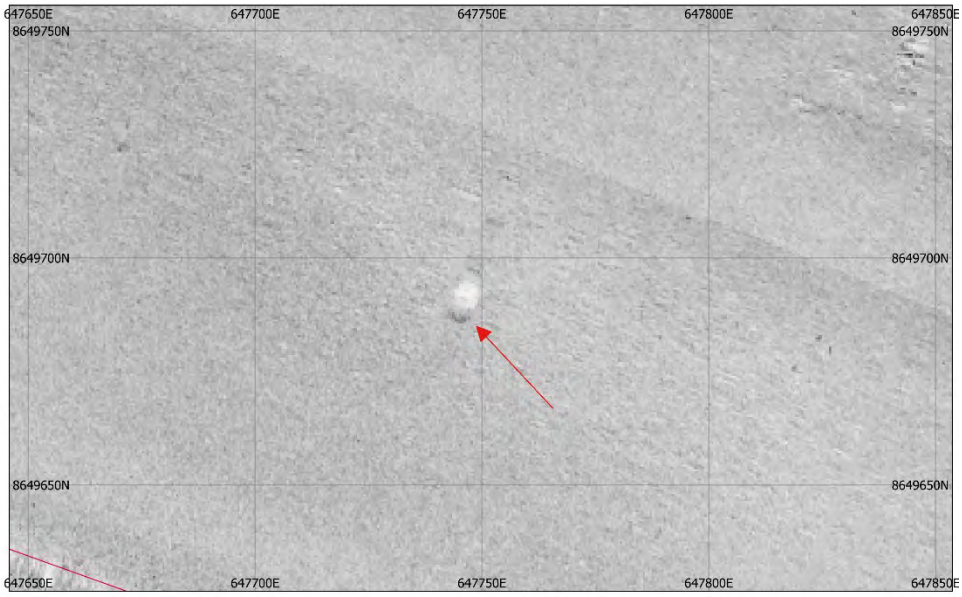


Figure 62: SSS view of anomaly 234.

Anomaly 138: KP 97 – 98 (mound in proximity to anchor scars)

Anomaly 138 appears on SSS to be a relatively large mound, measuring 13m by 16m, and is in close proximity to a pair of gouges on the seabed, crossing in an "X" pattern, identified as C Class anomaly 236. It is believed that these gouges are likely anchor scars. Both gouges are approximately 75m long and 6m wide.

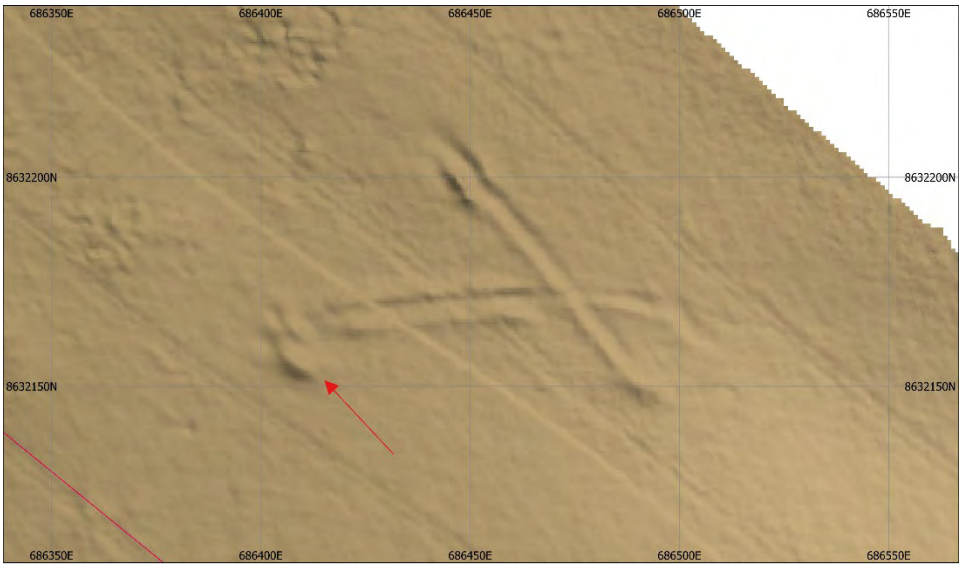


Figure 63: MBES image of Anomaly 138 with associated seabed gouges in X pattern. Anomaly 138 marked by red arrow.

Anomaly 239: KP 115 – 116 (USAT Mauna Loa)

Anomaly 239 is located at approximately KP 116 and is identified as the wreck site of USAT *Mauna Loa. Mauna Loa* was a steel hulled US military cargo ship, measuring 410 feet in length, 54 feet in depth, and 5,436 tons. The vessel was sunk by Japanese aircraft during a raid on Darwin on February 19, 1942, resulting in five casualties (see Section 4.3.1, Figure 19, and Figure 21).[111] Although the upper portions of the wreck were removed during salvage operations between 1959 and 1960, the lower portion of the wreck, and its cargo, is largely intact. Cargo remains include motorbikes, ammunition, gun carriers, and trucks.[112] The wreck is well known and protected under the *UCHA 2018, Northern Territory Heritage Act 2011,* and may be protected by the *SMCA 2004* (USA).

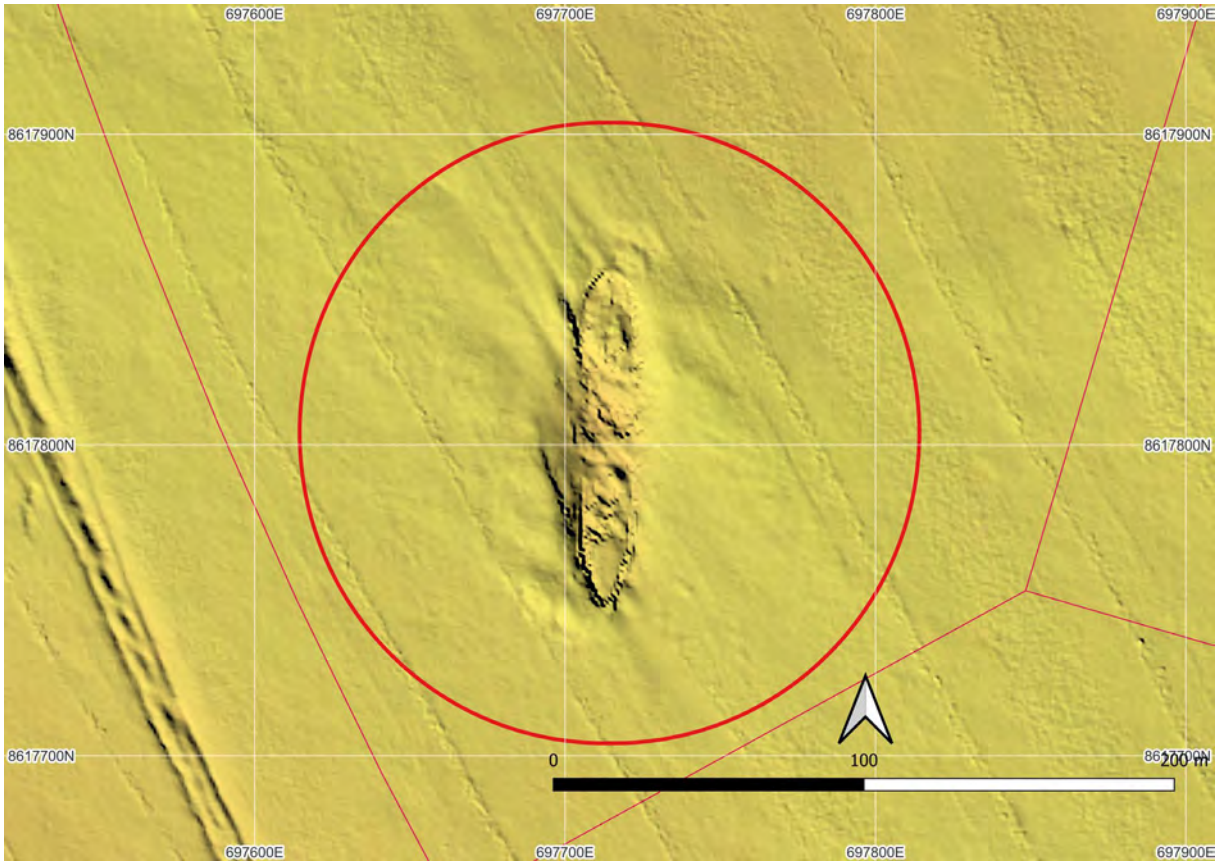


Figure 64: MBES image of anomaly 239, the USAT Mauna Loa. Statutory protection zone represented by red circle.

[111] **AUCHD,** shipwreck ID: 3503.
[112] **AUCHD,** shipwreck ID: 3503.

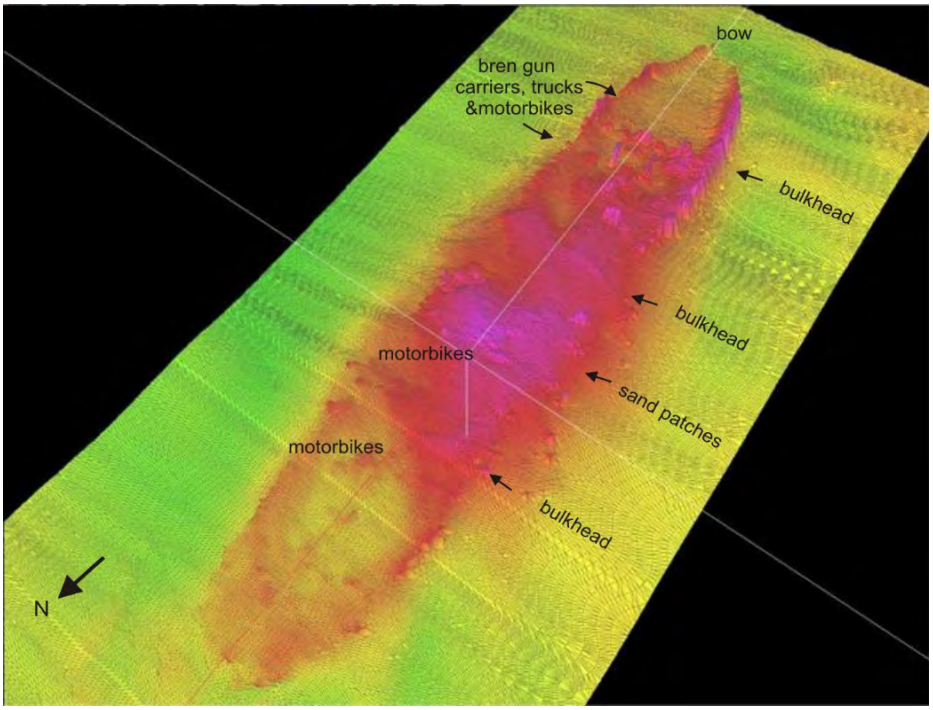


Figure 65: 2012 multi-beam sonar image of USAT Mauna Loa.[113]

Anomaly 210: KP 121 – 122 (unidentified debris)

Anomaly 210 is located between KP 121 and 122, approximately 360 m south of the proposed GEP route. The debris is unidentified, and due to the lack of comprehensive magnetometer data, it is unknown whether any ferrous material is present at the site. The shape of the debris bears a passing resemblance to known aircraft wrecks in the area, including five Consolidated Catalinas wrecked on the opposite side of Wickham Point, East Arm, Darwin (see Figure 67 and Figure 68). The size of the debris is approximately 12m by 7m - closer to the size of military fighter aircraft known to have operated over Darwin during World War II, such as RAAF Supermarine Spitfires (9m long fuselage and 11m wingspan), USAAF Curtiss P-40E Kittyhawks (9.6m long fuselage and 11.4m wingspan) and IJNAF Mitsubishi A6M2 “Zeros” (9m long fuselage and 12m wingspan). There are eight as yet unlocated World War II fighter aircraft wrecks that could potentially be situated within the study area – including six USAAF Kittyhawks, one RAAF Spitfire, and one IJNAF Zero (see Section 4.4.2).

[113] **AUCHD,** shipwreck ID: 3503.

Figure 66: Anomaly 210, unidentified debris.

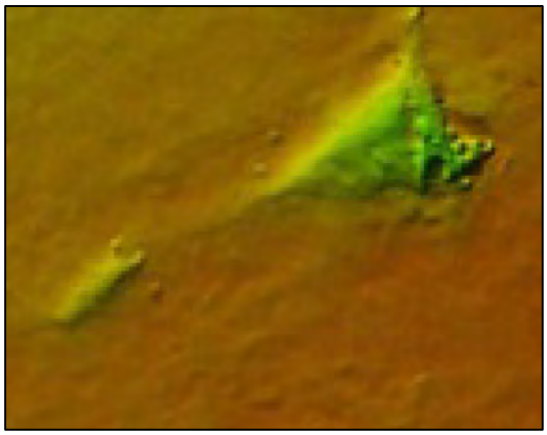


Figure 67: High resolution SSS image of Catalina 3, wrecked at East Arm.[114]

6.4.3 *Isolated Class B & C anomalies*

- *Anomaly 233: KP 46 – 47 (triangular depression)* - Anomaly 233 is a large triangular depression measuring roughly 39m by 8m. It was not identified as a magnetometer target and is likely a natural feature.
- *Anomaly 115: KP 56 – 57 (parallel depressions)* – Anomaly 115 is an isolated set of rectangular depressions measuring approximately 8m by 4m and may represent an area of debris or a natural feature.
- *Anomaly 130: KP 73 – 74 (possible debris field)* – Anomaly 130 is an area of numerous small, low-lying objects across a field approximately 18m by 8m. This likely represents a debris field, possibly of discarded objects, or an area of loose rocky seabed, which is incongruous with the surrounding flat sandy seabed. MBES and magnetometer survey did not cover Anomaly 130.
- *Anomaly 140: KP 101 – 102 (navigational buoy mooring)* – Anomaly 140 was determined to be in the same location as navigational buoy 5, used as a guide for the Port of Darwin shipping lane. Images seen on SSS and MBES are most likely the mooring and mooring line for Buoy 5.
- *Anomaly 141: KP 102 – 103 (possible field of large debris)* – Anomaly 141 is an area of several large, high-profile ridges across a total area measuring 53m by 20m, with each individual portion measuring 6 – 12m across. Objects are likely natural rocks, as similar features become more frequent following KP 113, or are cultural in origin, possibly indicating a dump site.
- *Anomaly 142: KP 102 – 103 (possible debris)* – Anomaly 142 is located approximately 150m southwest of Anomaly 141 and lays on the proposed GEP route. 142 appears similar to 141 on MBES, and on SSS appears as several relatively high-profile objects in a field roughly 13m by 8m.
- *Anomaly 235: KP 96 – 97 (anchor drag)* – Anomaly 235 is an anchor drag, vaguely U-shaped and measuring 244m in total length and 5m in width.

[114] **AUCHD,** Aircraft Id: 8072.

6.4.4 Isolated Magnetic Anomalies

Three isolated magnetic anomalies were detected during magnetometer surveys. One is located beyond 50m from the proposed GEP route, one located approximately 35 m from the route, and one is located 6.4 m from the proposed route. These anomalies are inferred to be buried ferrous debris. Thus, these targets may represent buried cultural items.

- *MA_001: KP 115.846* – inferred buried debris, 13.3 nT magnetic intensity, 35.3m from GEP route. This magnetic anomaly was initially thought to possibly be associated with USAT *Mauna Loa,* because it is located approximately 65m from the wreck site. MA_001 was inspected during ROV survey and confirmed to be the remains of a buoy mooring.
- *MA_007: KP 111.508* – inferred buried debris, 21.5 nT magnetic intensity, 6.4m from GEP route. MA_007 was inspected during ROV survey. An unidentified metal structure was seen at the location of MA_007 and was assessed as cultural in origin. This structure may represent wreckage remains or discarded debris.
- *MA_031: KP 117.376* – inferred buried debris, 34.3 nT magnetic intensity, 145.6m from GEP route.

7 ROV SURVEY

7.1 Conduct of field survey

As part of environmental and heritage impact assessments, a geophysical survey was conducted, including multi-beam bathymetry (MBES), side scan sonar (SSS), and magnetometer surveys, to identify locations of potential cultural material (see Section 6). Review of the available geophysical survey data identified forty targets of possible cultural origin (see Section 6.3). Sixteen of these targets were located within 50m of the proposed GEP route and were shortlisted for visual survey to potentially confirm their identity and significance (Figure 69). In addition to these individual targets, three transects were planned solely for heritage purposes in the location of known WWII anti-submarine netting (Figure 70). The sixteen chosen targets were inspected over the course of three days between 6-8 June 2022.

Figure 68: Location of ROV survey shortlisted targets. All targets located between KP 102 and KP 118.

Figure 69: Location of ROV survey heritage transects between KP 107 and KP 108.

The objectives of this ROV survey were to:

> *Visually inspect targets identified through geophysical data for their potential cultural heritage significance and recommend measures to reduce impacts to their cultural heritage values.*

The underwater heritage survey was conducted with the use of an ROV, operated by crew from FUGRO under the direction of the maritime archaeologist. The features believed to be the anti-submarine net mooring trots were surveyed along transects following the features in a linear pattern. Isolated targets were targeted by dropping a clump weight with a buoy attached on the target coordinates while the vessel was moving, and then following the buoy line to the seabed with the ROV once the vessel was anchored. Once on the bottom, the ROV was manoeuvred in cross shaped search patterns, 10m out in each cardinal direction, using the clump weight as a reference point.

The ROV was battery powered and controlled remotely by the pilot from inside the survey vessel cabin. Because the ROV was not equipped with transponders or any location fixing devices, the exact location of the ROV had to be estimated based on identifiable features on the seabed that could be compared to MBES data, course headings, and position relative to the survey vessel.

7.2 Summary of ROV survey findings

In total, 21 ROV dives were attempted to locate and identify potential cultural objects identified in the marine geophysical survey. Of these 21 dives, 3 were aborted due to poor conditions or issues with the ROV. Despite these failed attempts, ROV surveys were conducted on all 16 targets shortlisted for ROV survey.

Remains of historic maritime infrastructure were identified during the ROV surveys (Figure 71). The remains of WWII anti-submarine boom net moorings were clearly identified by the three heritage transects.

Figure 70: ROV survey shortlisted target locations overlaid on map of known historic maritime infrastructure in Darwin Harbour.

Heritage Transects 1, 2, and 3 identified the remains of WWII anti-submarine net moorings near the entrance to Darwin Harbour. It was concluded based on these surveys that the northern and southern mooring trots (Transects 2 and 3) did not cross the proposed GEP route (Figure 72). It was noted that the northern end of the trot surveyed by Transect 2 was anchored with a potentially historical ships anchor.

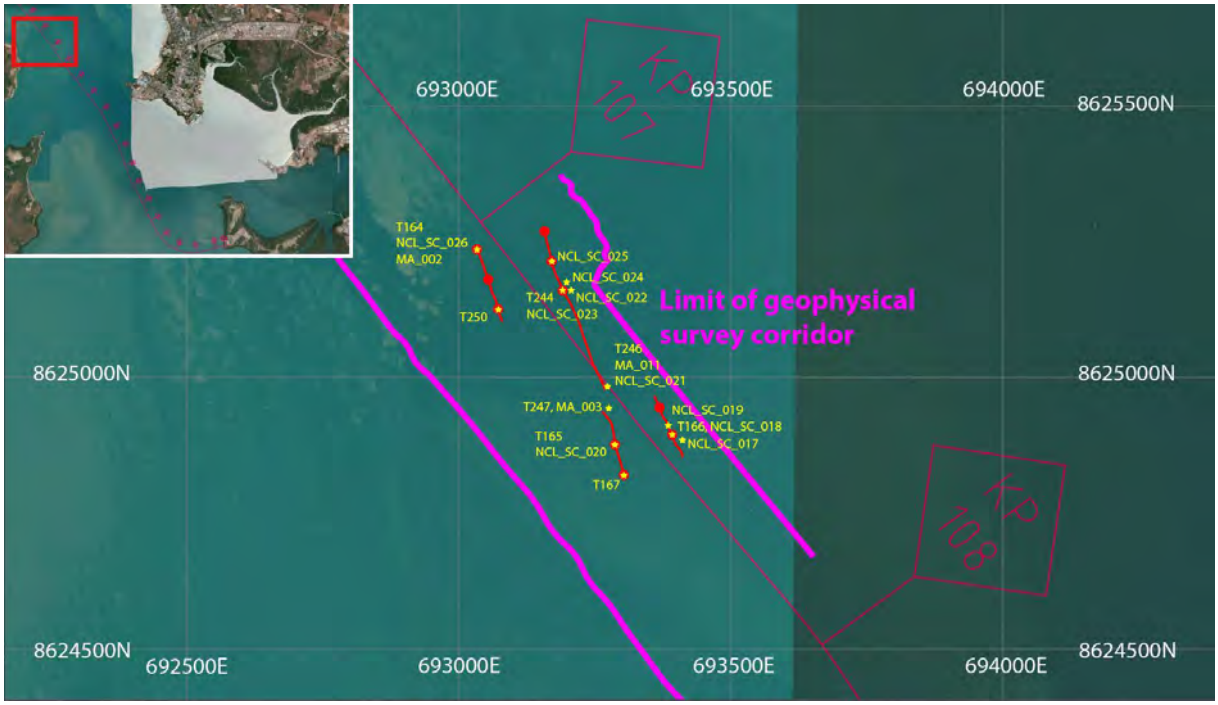
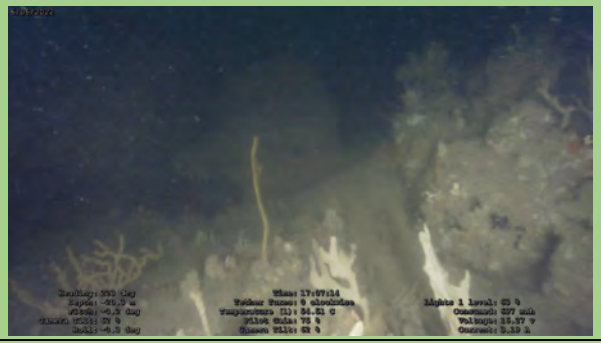
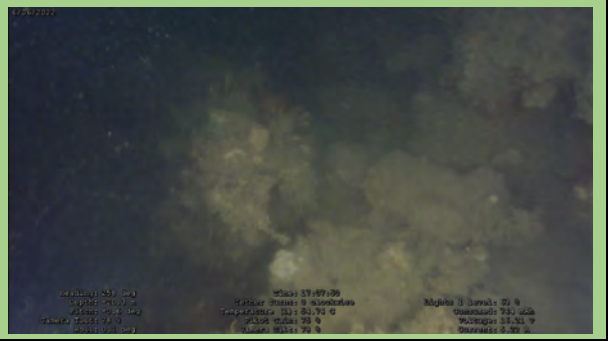
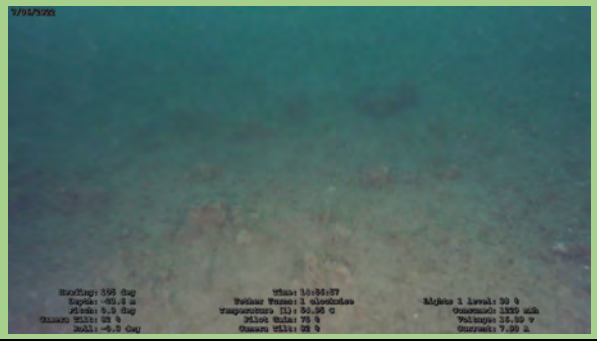


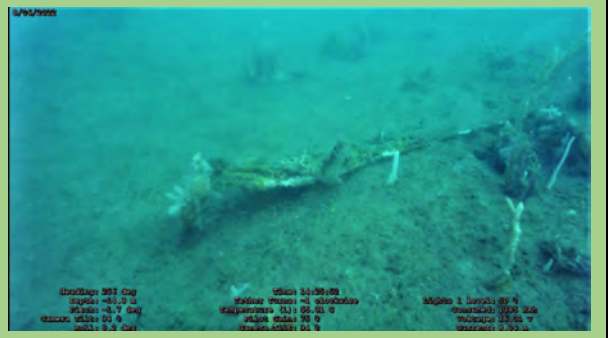
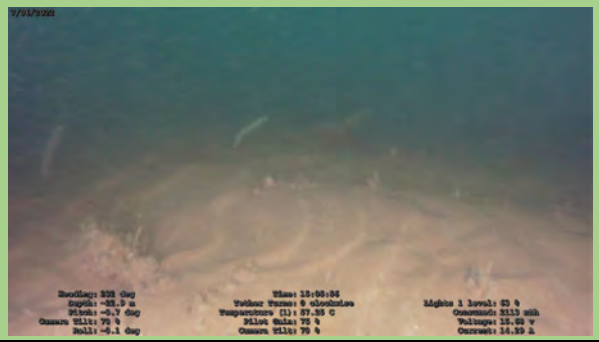
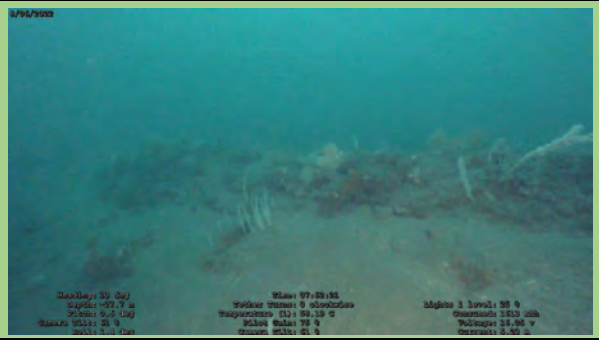
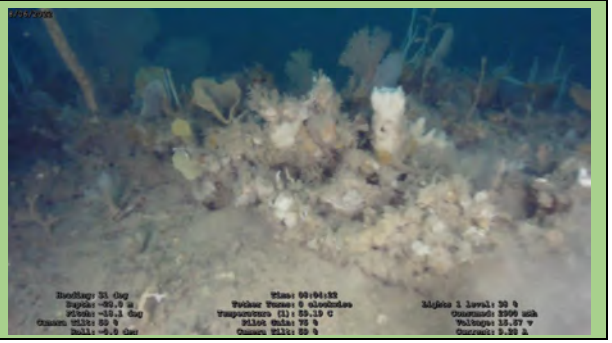
Figure 71: Location of anti-submarine net trots identified during ROV surveys. Circles represent mooring blocks/anchors, lines indicate chains in between blocks, stars represent geophysical survey anomalies, with IDs.

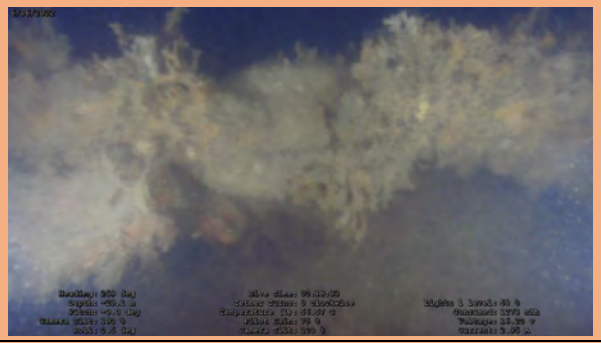
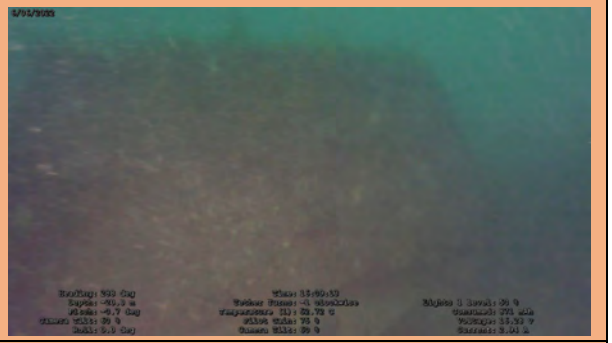
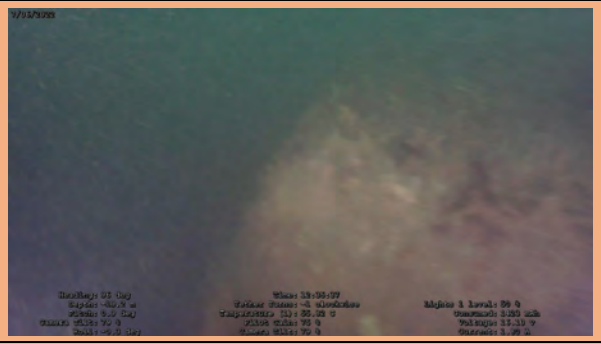
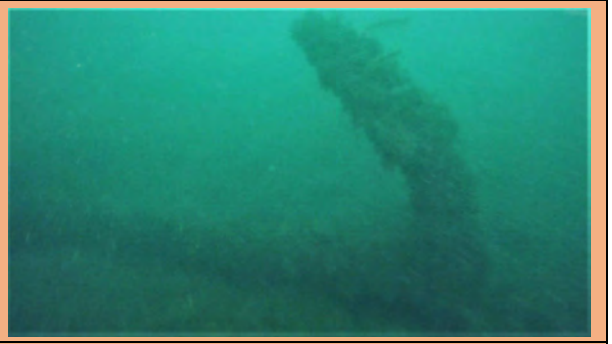
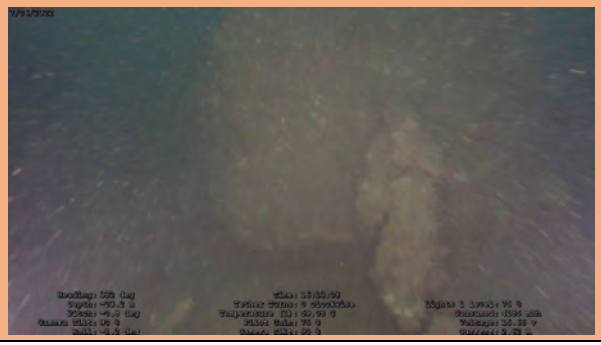
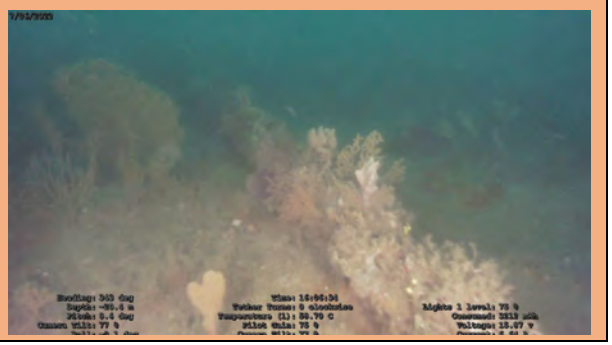
ROV survey of the middle trot (Transect 1) identified mooring chains that did cross the proposed GEP route. However, it was also seen that a gap exists between sections of the chain, southeast of the location of Target 246, which was not located.

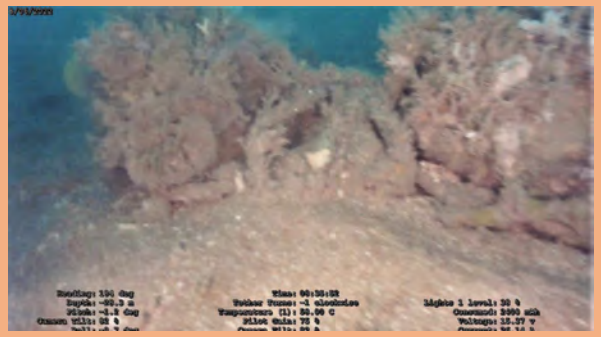
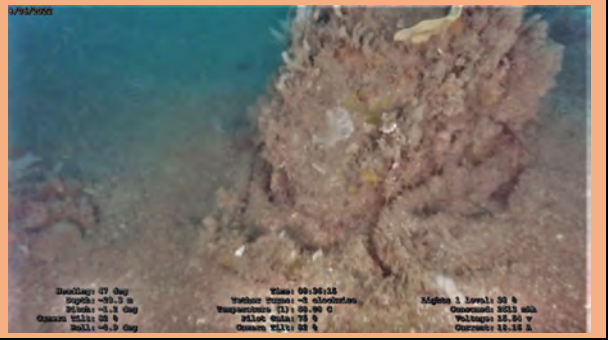
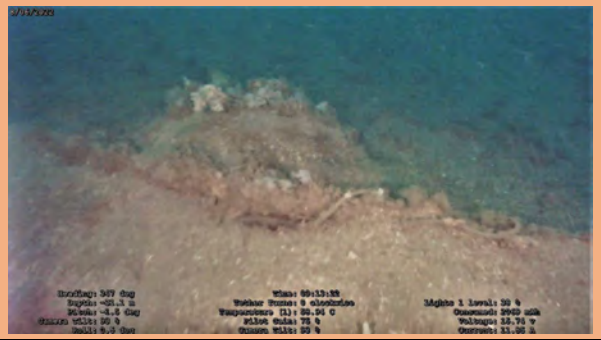
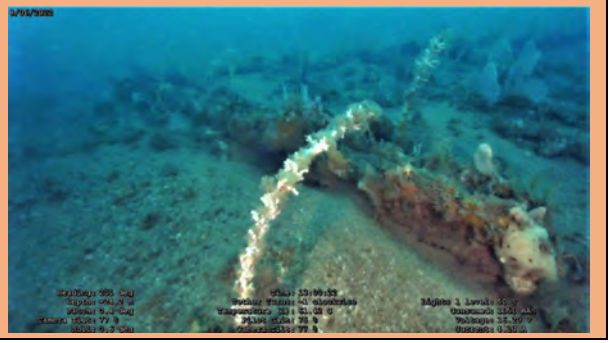
Individual dives on 10 isolated heritage targets identified 6 instances of natural features, not considered to be cultural in origin. The remaining four are conclusively cultural. All three heritage transects identified cultural remains. Table 11 summarizes the results of the survey of these features. The full summary of the ROV survey is attached to this report as Annex A.

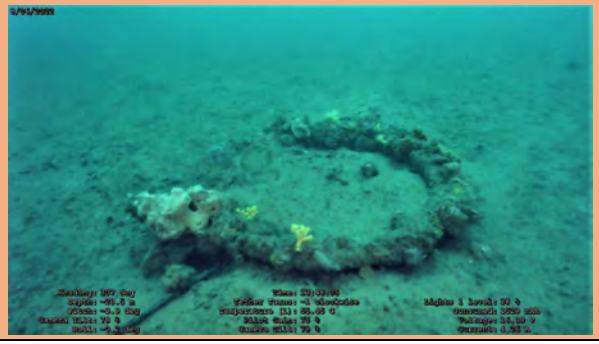
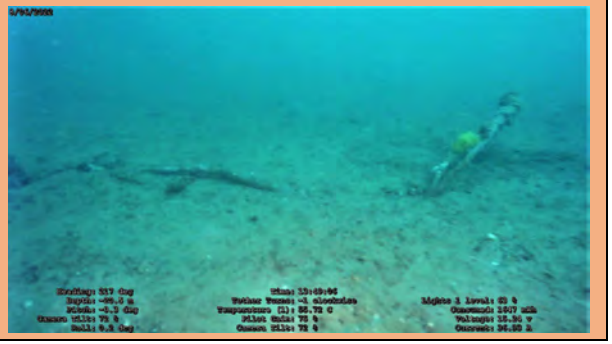
Table 11: ROV survey target identification

Target ID	Likely identification	Cultural/Natural	Image 1	Image 2
142	Boulders	Natural		
245	Rock rubble	Natural		
241	Shallow depression	Natural		

Target ID	Likely identification	Cultural/Natural	Image 1	Image 2
NCL_SC_002	Rock ridge	Natural		
NCL_SC_031	Sand ripples	Natural		
175	Narrow rock/coral ridge	Natural		

Target ID	Likely identification	Cultural/Natural	Image 1	Image 2
Heritage Transect 1 (incl. Targets MA_003, 011; Targets NCL_SC_020, 021, 022, 023, 024, 025; Targets 165, 167, 244, 246, 247)	Anti-submarine net mooring trot	Cultural		
Heritage Transect 2 (incl. Targets MA_002; Target NCL_SC_026; Targets 164 and 260)	Anti-submarine net mooring trot, with ship's anchor as northernmost mooring	Cultural		
Heritage Transect 3 (incl. Targets NCL_SC_017, 018, 019; Target 166)	Anti-submarine net mooring trot	Cultural		

Target ID	Likely identification	Cultural/Natural	Image 1	Image 2
174	Possibly winch, windlass, or ship's bollard	Cultural		
NCL_SC_016	Telegraph or other cable	Cultural		
MA_007	Metal structure, possible wreckage	Cultural		

Target ID	Likely identification	Cultural/Natural	Image 1	Image 2
MA_001	Buoy mooring and cable	Cultural		

7.3 Interpretation of survey results

7.3.1 *Anti-submarine net mooring trots (Heritage Transects 1, 2, and 3)*

In response to the threat of a Japanese invasion, a network of anti-submarine infrastructure was constructed around Darwin Harbour. This included the construction of a 6 km-long anti-submarine boom net, between Dudley Point and West Point (see sections 4.2.6, 4.3.3). Indicator loops and sonar systems were also put in place at the entrance to Darwin Harbour to detect any ships moving near the boom gates.

The submarine boom net was anchored to the seabed with 5- and 8-ton concrete clumps. A total of 265 clumps were used for the boom, which were arranged in groups of eight. Each group of eight clumps was called a “trot” and each trot was laid out 195 ft (~60m) apart, perpendicular to the axis of the submarine net. The clumps were connected by 2” chain.

ROV surveys visually identified the locations of nine mooring clumps, and one ship’s anchor repurposed as a mooring clump, representing three separate trots. The locations of the three trots located during the ROV survey correspond roughly to trots 16, 17, and 18 shown on historic charts (see Figure 73).

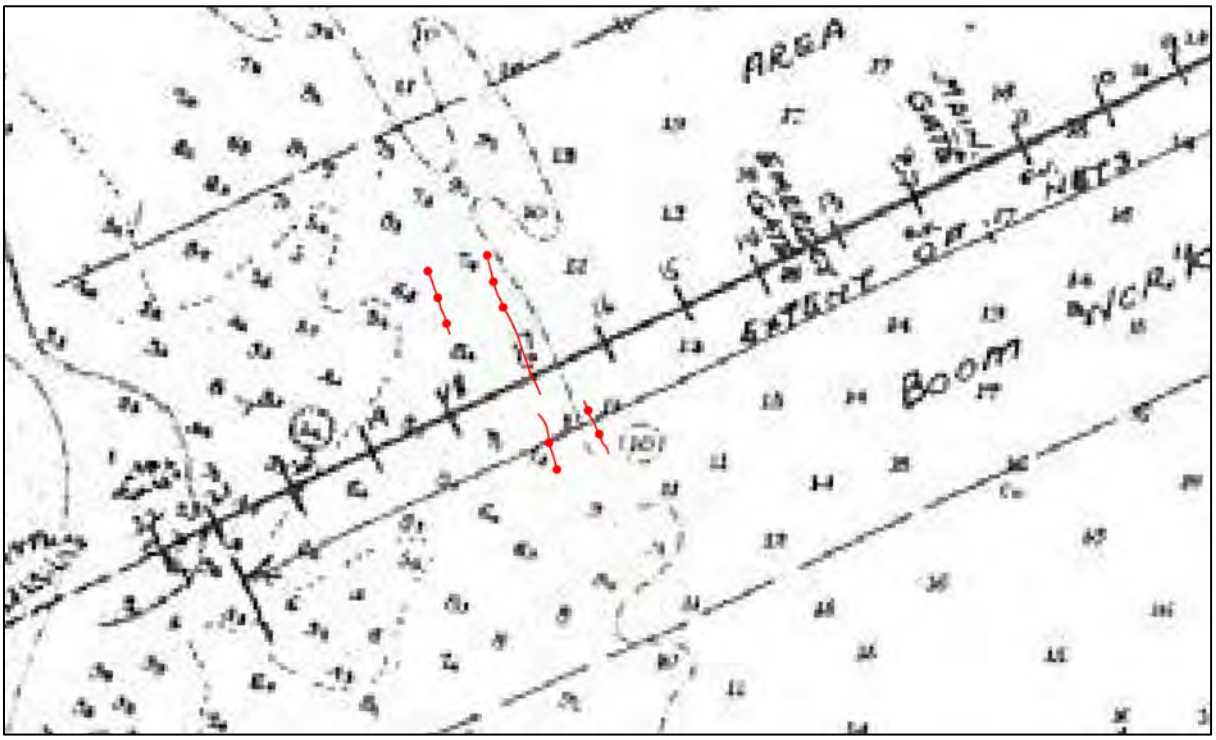


Figure 72: Historic chart of WWII anti-submarine boom net mooring trots overlaid with location of clump weights and chain identified by ROV (in red).

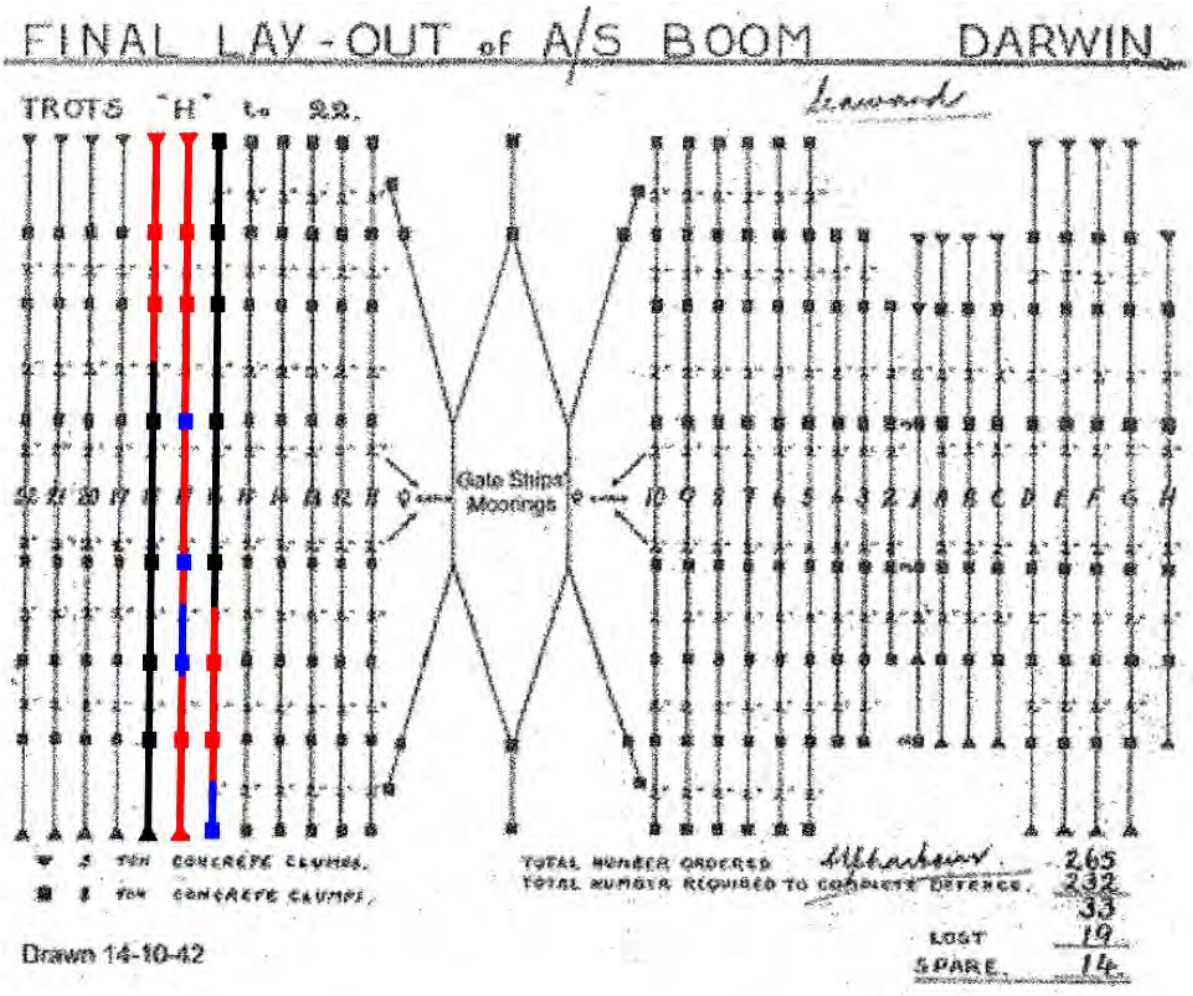


Figure 73: Schematic of anti-submarine net trots, with surveyed net trots highlighted. Clump weights shown by rectangles and triangles and chain shown by lines. Red represents features identified during ROV survey, blue represents features that were missing, and black represents features that were omitted from the survey.

Heritage Transect 1 (Trot 17)

Heritage transect 1 corresponds with the location of trot 17, and is the central trot of the three surveyed. Five mooring clumps were identified along this trot, two on the southern end, including the southernmost clump, and three on the northern end, including the northernmost clump. The location of the other three mooring clumps is unknown. The entire length of the trot is approximately 482m.

The chain ran continuously between the Clump 8 (northernmost) to around the location of where the Clump 4 should have been. At this location, there was a break in the chain, with an array of metal chain branching in multiple directions. The nature of this structure is unknown; however, it is clearly connected to the chain and the northern clump weights. Likewise, the chain from Clump 1 (southernmost) was observed to run from Clump 1 to Clump 2 unbroken before disappearing near the location where Clump 3 should have been. There appears to be a gap between the southern section of the mooring trot and the northern section of approximately 20-30m where no chain or clumps were observed. Between Clumps 5 and 6, a large kink was seen in the chain, indicating that it had perhaps been dragged out of position by an anchor or trawler.

Four of the five clumps observed appeared to be the 8-ton trapezoidal concrete weights shown in Figure 30 in section 4.3.3. Clump 2 appeared on video as a twin set of concrete blocks.

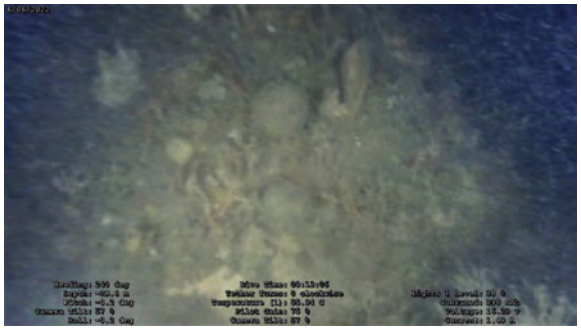


Figure 74: Clump 1 (aka geophysical target 167).

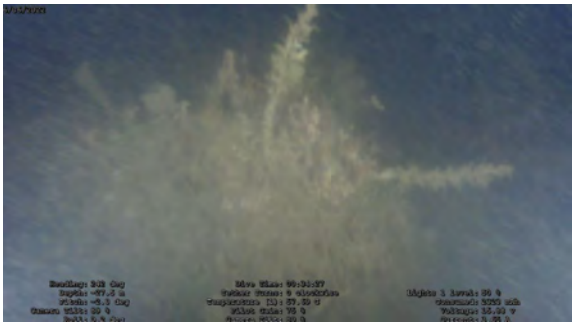


Figure 75: Trot 17, Clump 2 (aka geophysical anomaly NCL_SC_020).

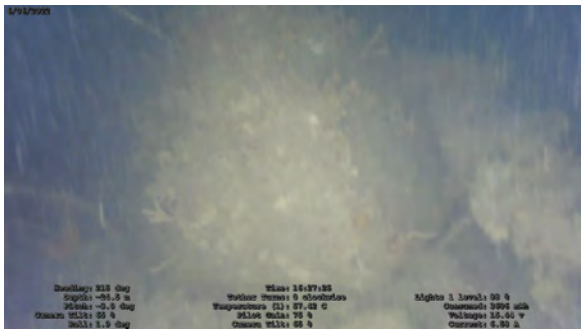


Figure 76: Trot 17, Clump 6 (aka geophysical anomaly 244).

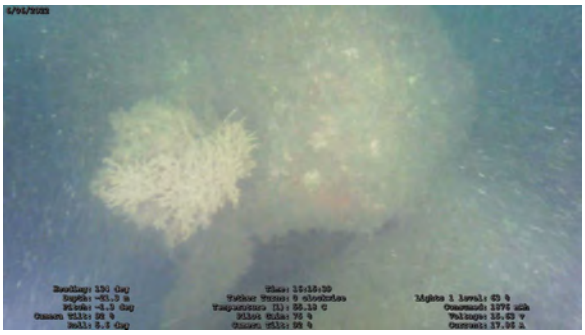


Figure 77: Trot 17, Clump 7 (aka geophysical anomaly NCL_SC_022).

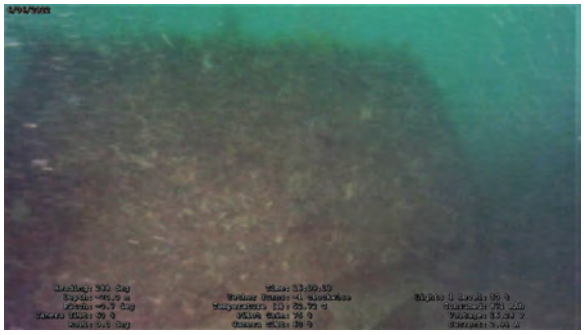


Figure 78: Trot 17, Clump 8 (not identified during geophysical survey).

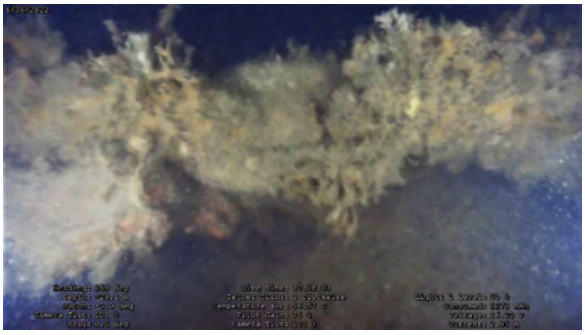


Figure 79: Detail of chain between Clumps 1 and 2.

Heritage Transect 2 (Trot 18)

Heritage Transect 2 corresponds roughly with the location of Trot 18 and is the western trot of the three surveyed. Three mooring clumps were observed by ROV survey comprising most of the northern half of the trot (Clumps 6, 7, and 8). Several of the southern clumps are clearly visible on geophysical survey data. Trot 18 is bisected by the Bayu-Undan GEP, with Clump 5 almost abutting the pipeline as seen on MBES and SSS data. The southern sections of Trot 18 were not surveyed, as their proximity to the existing GEP and their distance from the proposed GEP indicated they are unlikely to be impacted by the proposed works.

The chain ran continuously from Clump 6 to Clump 8, with no breaks or kinks. Clumps 6 and 7 were observed to be the same trapezoidal concrete weights identified in Trot 17, with the same gauge chain connecting them. Clump 8 was unique however, as it consisted of a large

ship's anchor that had apparently been repurposed as a mooring for the anti-submarine net. The anchor appeared to be an admiralty pattern style, with a long narrow shank and curving arms with triangular flukes. The anchor laid perpendicular to the seabed, with one arm buried and one arm standing proud from the seafloor. A large rectangular stock was observed, with what appeared to be metal bands wrapped around the sides, indicating that the stock is possibly (but very unlikely) of wooden construction. However, it was impossible to determine from ROV footage precisely what material was used for the stock due to the extensive marine growth covering it. The crown of the anchor was connected to the trot chain with a large D-shackle.

The ROV's depth gauge was used to measure the length of the visible arm by taking a depth reading at the top of the fluke and another at the seabed. The arm measured approximately 1.9m in length, while measurements taken from SSS data indicate that the total length of the shank is approximately 4m.

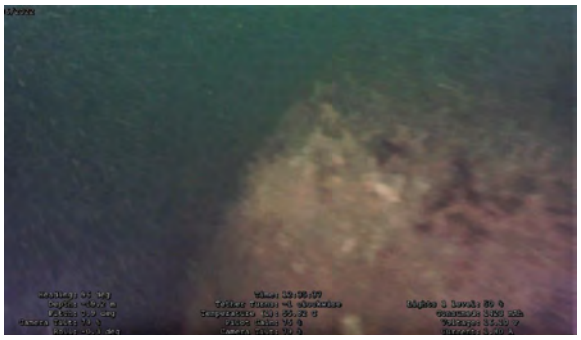


Figure 80: Trot 18, Clump 6.

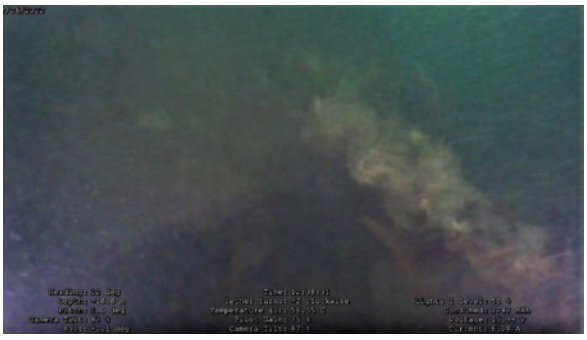


Figure 81: Trot 18, Clump 7.

Figure 82: Trot 18, Clump 8, repurposed ship's anchor. Photo shows anchor arm and fluke.

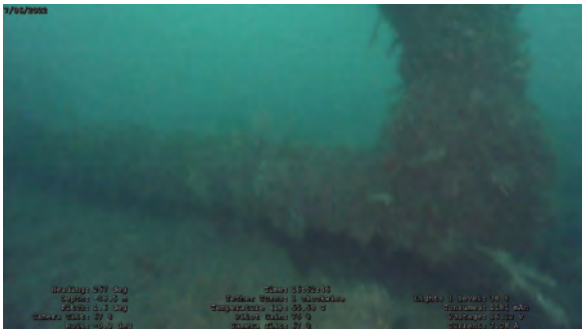


Figure 83: Trot 18, Clump 8, repurposed ship's anchor. Photo shows anchor throat and shank.

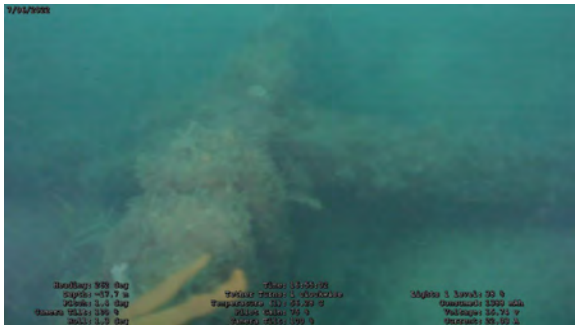


Figure 84: Trot 18, Clump 8, repurposed ship's anchor. Photo shows anchor stock and shank.

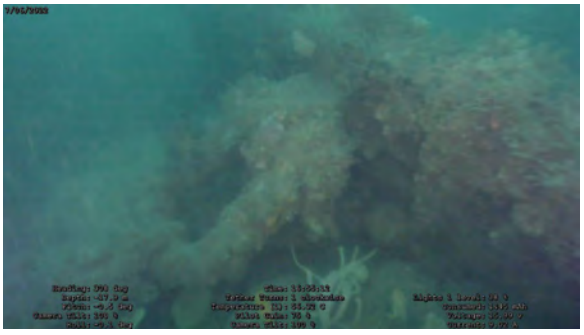


Figure 85: Trot 18, Clump 8, repurposed ship's anchor. Detail of stock and shackle connecting anchor to mooring trot chain.

Heritage Transect 3 (Trot 16)

Heritage Transect 3 corresponds roughly with the location of Trot 16 and is the eastern trot of the three surveyed. Two mooring clumps were observed by ROV survey, comprising a portion of the southern section of the trot (Clumps 2 and 3). The southernmost clump, Clump 1, was not observed on ROV survey or on geophysical survey data. The chain, running south from Clump 2, was observed to be severely kinked about 15m south of Clump 2 before ending abruptly. Further search of the area with ROV yielded no further evidence of the chain or Clump 1.

The chain ran continuously from Clump 2 to Clump 3 and extended north beyond Clump 3. It was decided to omit any survey of the northern section of the chain due to the distance from the proposed GEP route and the lack of geophysical survey data north of this location (see Figure 72 in section 7.2). Both clumps observed were 8-ton trapezoidal concrete weights.

Trot 16 had clearly been subjected to some disturbance, as the chain connecting Clumps 2 and 3 was heavily kinked and Clump 3 was observed to be upside down.

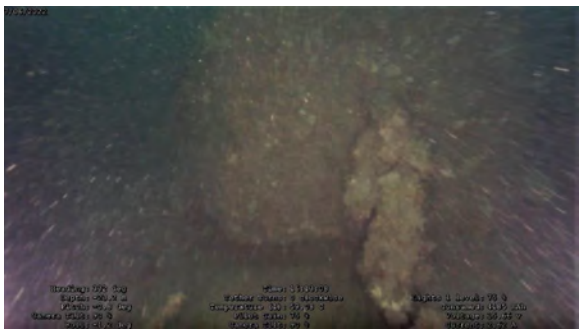


Figure 86: Trot 16, Clump 2 (aka geophysical anomaly 166).

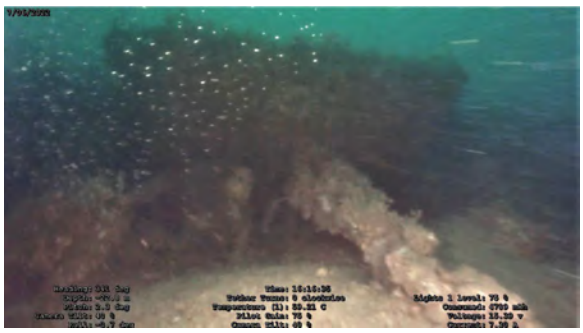


Figure 87: Trot 16, Clump 3. Note block appears to be flipped upside down.

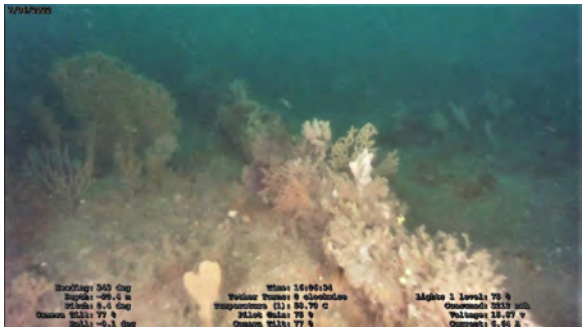


Figure 88: Chain between Clumps 2 and 3, Trot 16.

Figure 89: Chain south of Clump 2. Note right angle kink in chain (highlighted in red).

7.3.2 *Target 174 (winch, windlass, or bollard)*

Target 174 was located near KP 109, approximately 15m from the proposed GEP route. Investigation of the target by ROV found a small metal structure, reminiscent of a dumbbell weight, with two vertical protuberances sticking out of the seabed. The seabed around Target 174 was flat and sandy, relatively featureless, and showed no other debris or cultural material within the immediate vicinity of the target. A length of rope was observed wrapped around the centre of the object with a coil underneath one part. Initial identification suggested that the target was a small ship's winch or windlass, or possibly a bollard. The lack of other identifiable cultural material in the area, i.e., wreckage, suggests that this is an isolated artefact that may have been deliberately discarded or accidentally lost. The exact nature of the cordage is unknown. If the rope is synthetic poly-rope, it would most likely be modern and not historically significant. If the rope is made of natural fibre, it is possible that the object is historic. Flexible steel wire rope has been in use since WWII and could represent historic cultural heritage.

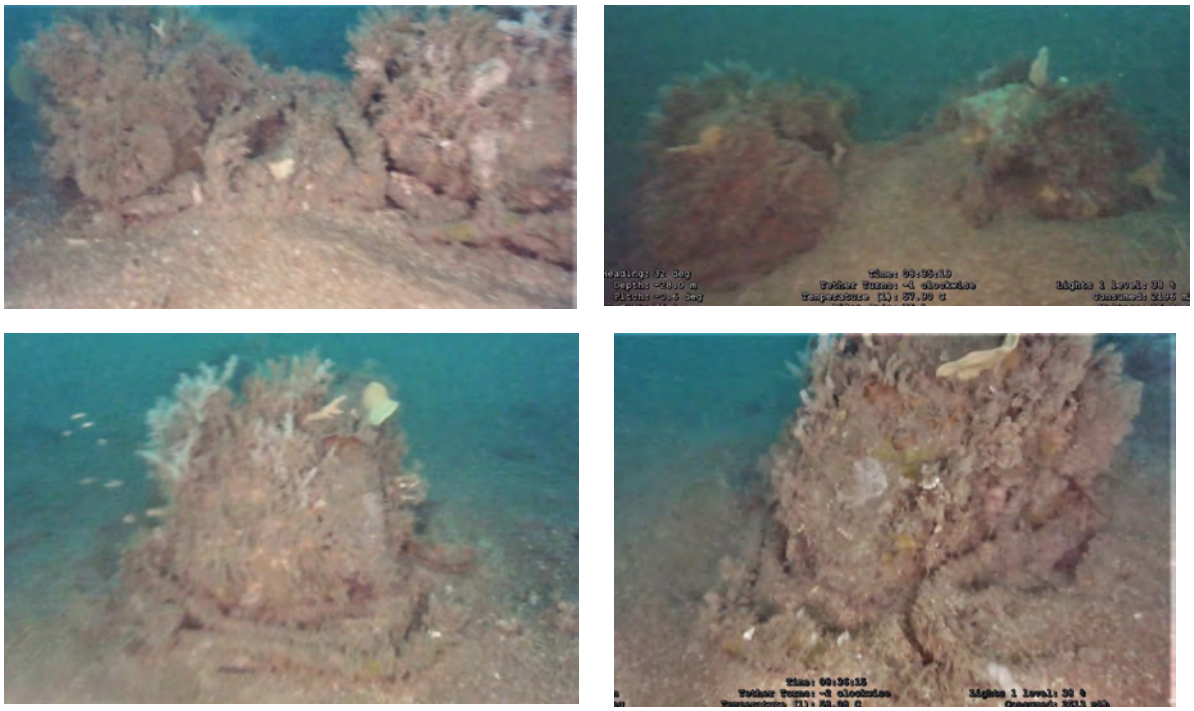


Figure 90: Images of Target 174 taken from ROV survey. Note rope wrapped around middle of structure.

Figure 91: "Coastal trading vessel MV* Zenalyn *(ex-Catalina refuelling vessel) in Darwin Harbour." Note winch on foredeck (detail of winch on right).[115]

[115] **Spillet, P. ca. 1950s-1960s**. "Coastal trading vessel MV Zenalyn (ex-Catalina refuelling vessel) in Darwin Harbour." Library & Archives NT, image PH0238/4149.

Figure 92: "Winches on the deck of Fujita Salvage Boat." Note bollard at bottom of picture.[116]

Figure 93: Small winch with rope used on Darwin working vessel, 1975.[117]

7.3.3 *MA_007 (unidentified metal structure)*

Target MA_007 was identified during geophysical surveys as a magnetic anomaly, with no discernible images seen on MBES and SSS. The target is located approximately halfway between KP 111 and 112 and is roughly 6m from the proposed GEP route.

ROV survey identified a field of debris located in a mostly sandy seabed. The debris was partially buried and had a low relief above the seabed. The primary artefact observed was a rectangular metallic structure made up of multiple rows of connected small beams. It was not possible to take measurements with the ROV, so the full scale and size of the structure, along with its composition, is unknown. The main structure is estimated to be roughly five metres long and 2 metres wide. Small fragments of apparently associated material were scattered around the primary structure in a debris field.

It is unknown, with the data available, whether Target MA_007 represents the wreckage of a vessel or aircraft, deliberate or accidental discard of materials, or disarticulated maritime infrastructure. The main structure bears some resemblance to historic photographs of small work barges as well as the internal support structures of some aircraft hulls and wings. Further investigation is needed to conclusively identify what the remains are likely to be.

[116] **Fujita Salvage Company, 1960**. "Winches on the deck of Fujita Salvage boat." Library & Archives NT, Senichiro Fujita Collection, PH0874/0120.
[117] **Bruce, H. 1975**. "Kay Laforest, Darwin." NLA PIC P805/30a LOC Q28.

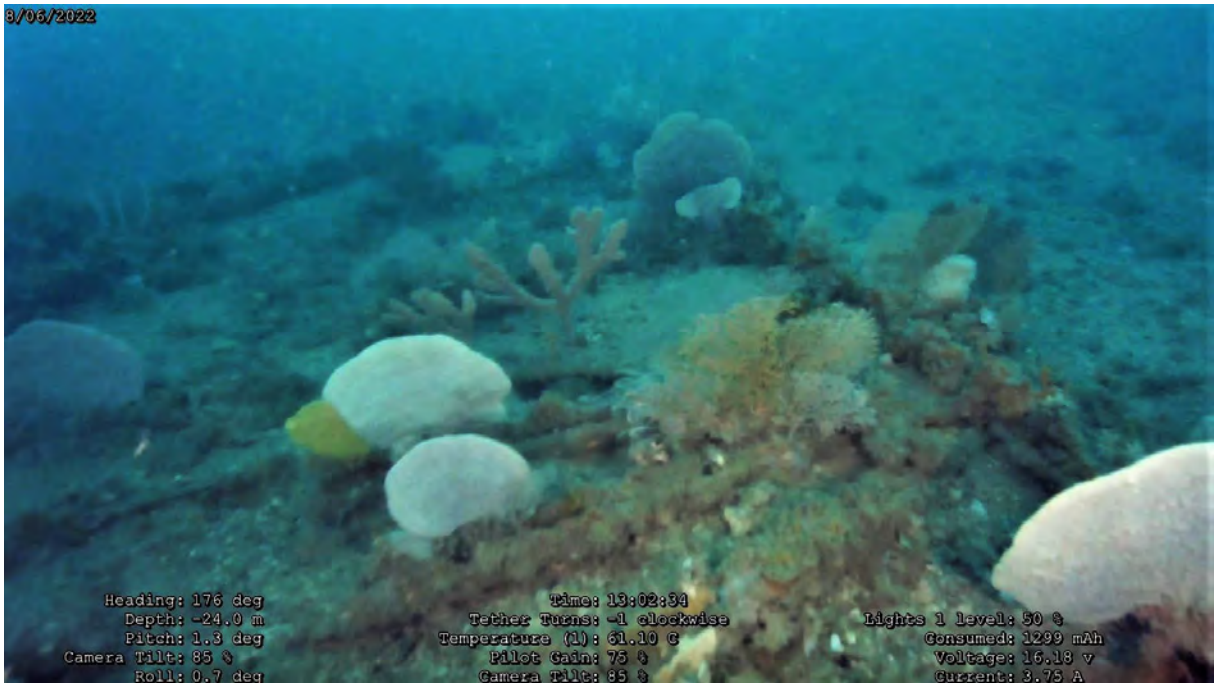


Figure 94: Target MA_007 as seen during ROV survey.

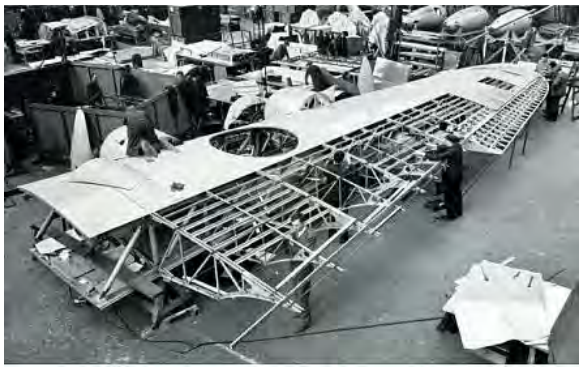


Figure 95: Short Empire flying boat wing under construction, showing structure of internal supports.

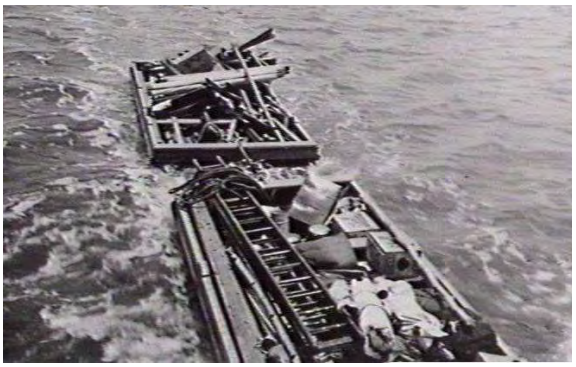


Figure 96: "Barges with materials for leper station being towed across harbour" 1937.[118]

7.3.4 *MA_001 (buoy mooring)*

Target MA_001 was identified during geophysical surveys as a magnetic anomaly, with no discernible images seen on MBES and SSS. The target is located approximately 150m north of KP 116 and is 35m from the proposed GEP route.

ROV survey identified three artefacts of cultural origin in the location of Target MA_001. The first located appeared to be a metal wheel rim and was mostly buried in sandy sediments. A small section of cable was observed protruding from the object. The second object, a length of metal cable with a loop tied in the end, was located a few metres away. It is believed that these two objects are related and represent the remains of a possible buoy mooring. The

[118] **Anon, 1937.** "Barges with materials for leper station being towed across harbour." Library & Archives NT, Australian Department of the Interior Collection, PH0125/0018.

wheel and cable are located within 70m of the wreck of USAT *Mauna Loa* and may be related to a navigational buoy used to identify the wreck site.

The third object noted was a piece of debris, likely concrete or metallic, with several wires protruding from the object. The exact composition of this artefact was impossible to determine by ROV survey, but may represent discard or a piece of wreckage, possibly from *Mauna Loa,* which was extensively salvaged in the 1950s (see section 4.3.1).

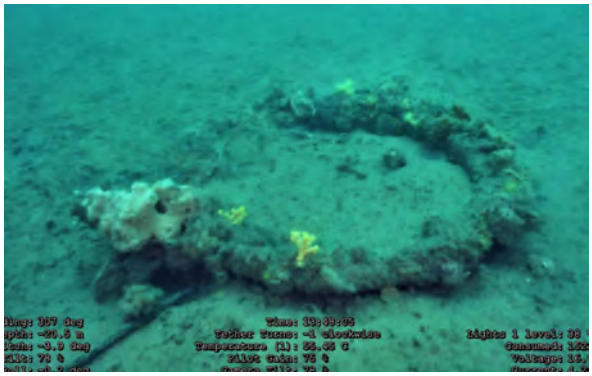


Figure 97: Metal wheel rim with cable protruding.

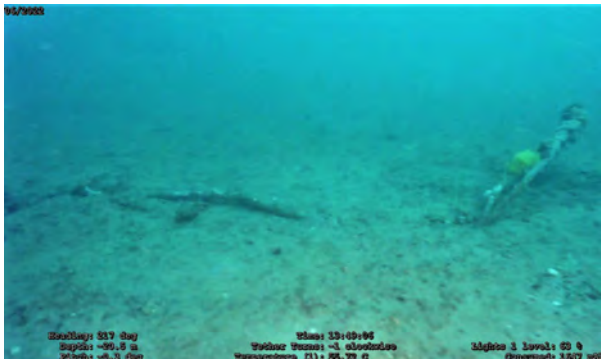


Figure 98: Mooring cable with loop at right of image.

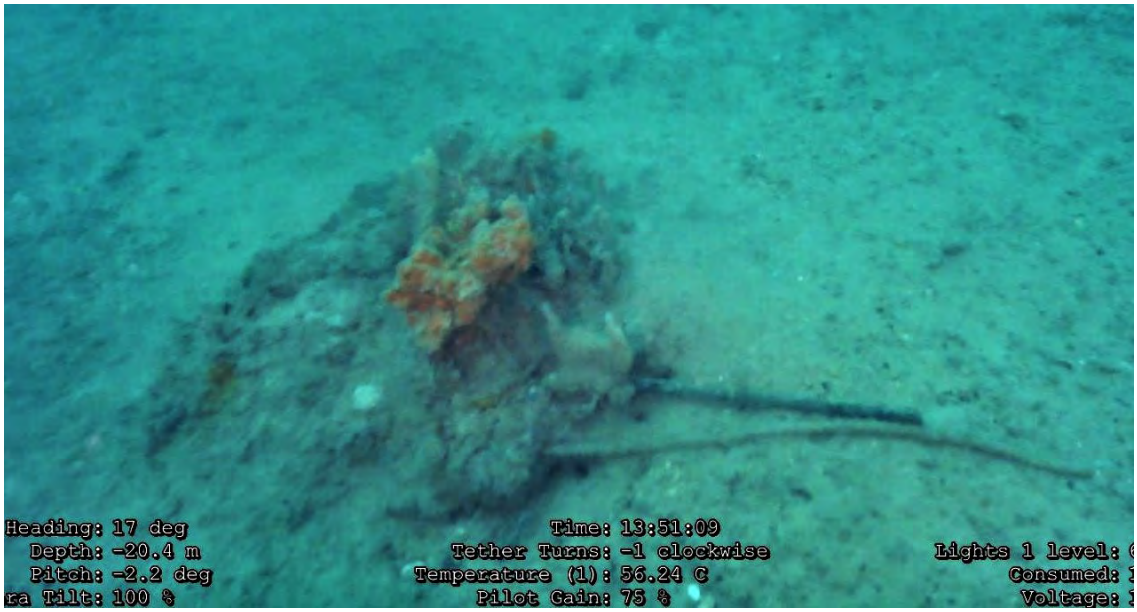


Figure 99: Unidentified debris located several metres north of wheel rim and cable.

7.3.5 *NCL_SC_016 (cable)*

Target NCL_SC_016 was identified during geophysical surveys as a “likely cable support”, appearing as a small linear feature on SSS and MBES. The target is located approximately 145m north of KP 109 and is 25m from the proposed GEP route.

ROV survey located a section of cable lying on the seabed which appeared to be disarticulated at both ends. The section of cable was approximately 35m in total length with a width of less than 100mm. The precise make up and composition of the cable could not be determined by ROV survey, so its identity cannot be conclusively stated. The object is located in an area known to have contained 19th century telegraph cables (see section 4.3.3) and may represent a section of a cable that was cut or disarticulated.

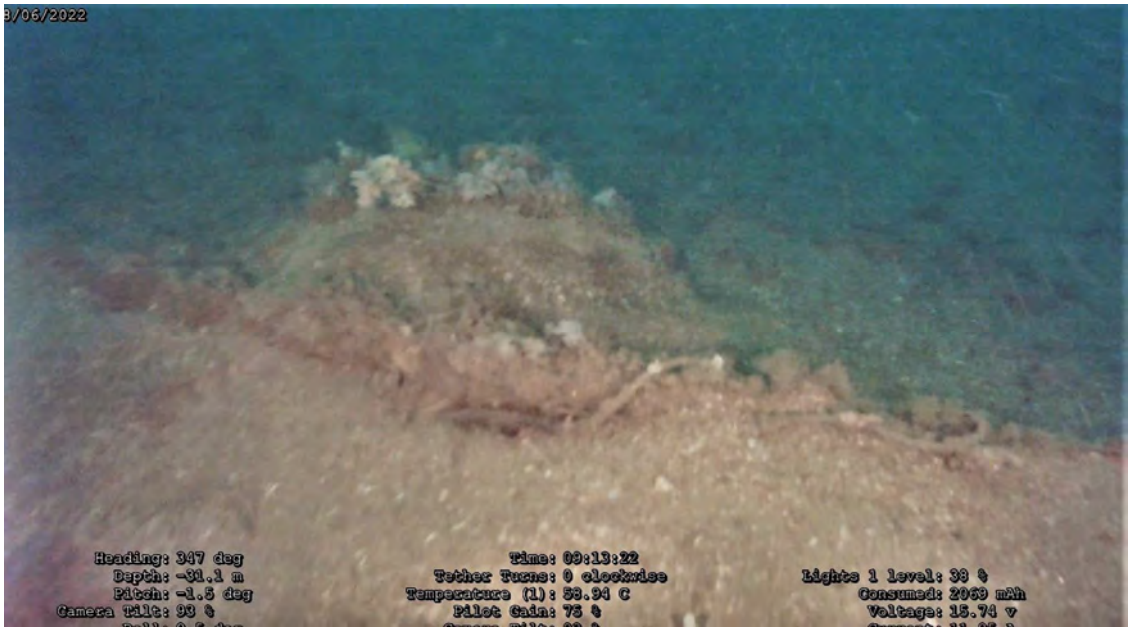


Figure 100: Detail of cable located at Target NCL_SC_016.

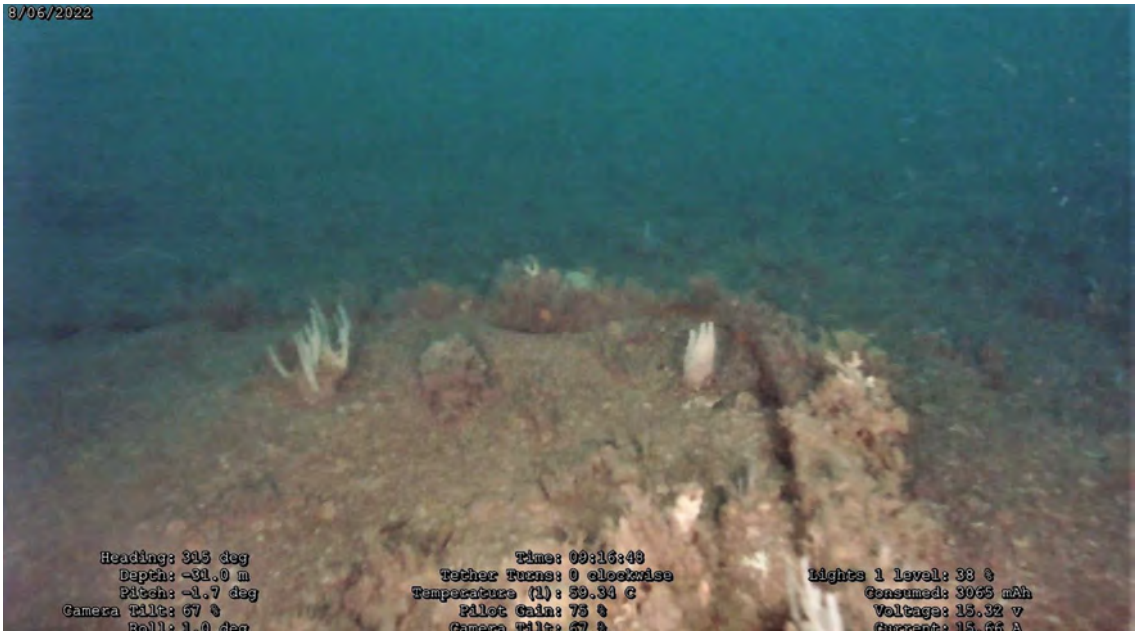


Figure 101: Detail of kink in cable.

8 DISCUSSION

8.1 Assessing cultural significance

Cultural Significance Criteria

All cultural objects have significance. The cultural significance of an object or a group of objects (a 'site') depends on what aspects of cultural activity the community values. In those jurisdictions where there are heritage laws, an established set of criteria is used to assess what objects or sites are eligible to be afforded greater statutory protection.

The Northern Territory *Heritage Act 2011* has provisions to declare a 'Heritage Place' or 'Heritage Object'. Such a declaration regulates activities within the site curtilage, hence protecting the site. To assist in the determination of whether a site, place, or object should be recommended for declaration under Part 2.2 of the Act, heritage assessment criteria (Part 1.2, Division 2, Section 11) have been established. The criteria are listed below.

A. *Whether it is important to the course, or pattern of the Territory's cultural or natural history;*
B. *Whether it possesses uncommon, rare or endangered aspects of the Territory's cultural or natural history;*
C. *Whether it has potential to yield information that will contribute to an understanding of the Territory's cultural or natural history;*
D. *Whether it is important in demonstrating the principal characteristics of a class of cultural or natural places or environments;*
E. *Whether it is important in exhibiting particular aesthetic characteristics;*
F. *Whether it is important in demonstrating a high degree of creative or technical achievement during a particular period;*
G. *Whether it has a strong or special association with a particular community or cultural group for social, cultural, or spiritual reasons, including the significance of a place to Aboriginal people as part of their continuing and developing cultural traditions;*
H. *Whether it has a special association with the life or works of a person, or group of persons, of importance in the Territory's history.*

The threshold for a site or object being declared is whether it can be demonstrated to have '…*special significance in the Territory'.* These cultural significance criteria have been adopted for this survey and all cultural objects found have been assessed against these criteria.

Cultural significance gradings

The Northern Territory heritage assessment criteria have been established to select sites/objects of 'special' significance to be protected. To date, no site/object found in the study area can be considered to have special significance. The significance of a site/object varies mostly depending on their rarity or representativeness and their condition; the latter point referring to the site/object's ability to provide information.

Table 12 provides five grades of cultural significance ranging from Minimal to Special. Identified cultural sites or objects have been assessed according to how well they may be able to contribute to the cultural heritage criteria set out in the Northern Territory Heritage Conservation Regulations.

Sites or objects can be considered of low significance if they are commonplace and recent even if they are associated with a significant individual or event. Such sites/objects, however, which are well preserved and are excellent representative examples can have an elevated level of significance. Higher significance tends to be given to those sites/objects which are older on the basis that such sites are rare and represent extinct or near extinct lifeways and/or technology. they can also be given higher significance because of their association with defining events in Northern Territory history; World War II being a good example.

Assessing the level of significance of each cultural object found will help determine what would be appropriate and proportionate mitigation measures against the proposed impacts. It may be sufficient for sites of low significance to be recorded *in situ* to a certain level before they are impacted. Other sites/objects could be considered significant enough to be excavated, relocated and/or recovered for conservation.

Table 12: Levels of cultural heritage significance.

Degree	Significance
Special	A rare or unique object or site in a relatively good state of preservation that provides an irreplaceable insight on the development of the Northern Territory and Australia. Eligible for listing as a 'Heritage Place' or 'Object'
High	A rare object or site type in a relatively good state of preservation that provides a new insight on the development of the Northern Territory and Australia.
Moderate	A rare object/site in a poor state of preservation or a common object/site in a relatively good state of preservation that provides an insight into the development of the Northern Territory.
Low	A common object or site type in a poor to fragmentary state of preservation that contributes to the understanding of the development of the Northern Territory.
Minimal	A ubiquitous object type, usually of recent manufacture, which provides little new information to the understanding of the development of the Northern Territory.

8.2 Preliminary evaluation

The following preliminary evaluation is based on the cultural significance of each of the 7 sites observed during the ROV surveys rather than individual objects (Table 13). Where the cultural significance of individual objects within a target varies, the significance rating of the target will be set to the highest rating object.

Table 13: Preliminary cultural significance assessments.

Target	Preliminary Significance Statement	Degree
Anti-submarine net Trot 16	WWII was a significant period in Australian and Northern Territory history and the remnants of the boom defence system related directly to the defence of Darwin Harbour during this period. Such items are rare as only a small number of boom defences were established in Australia during WWII. The anti-submarine defences of Darwin during WWII may have been the largest boom defence network in the world at the time. The boom defence mooring clumps and chains are *in situ* on the seafloor and in a good state of preservation. This makes them rare not only in the Northern Territory but in a National Context.	High

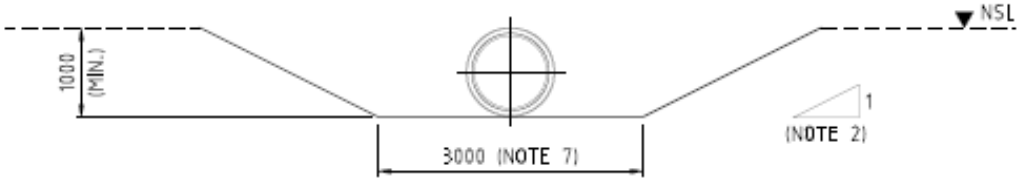
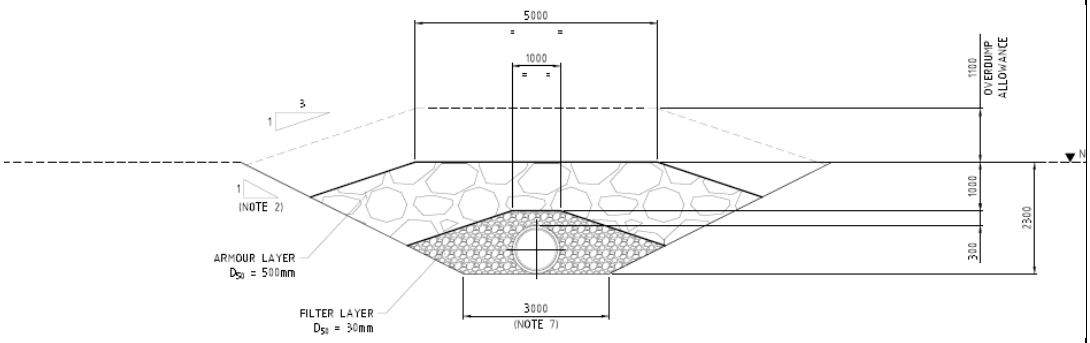
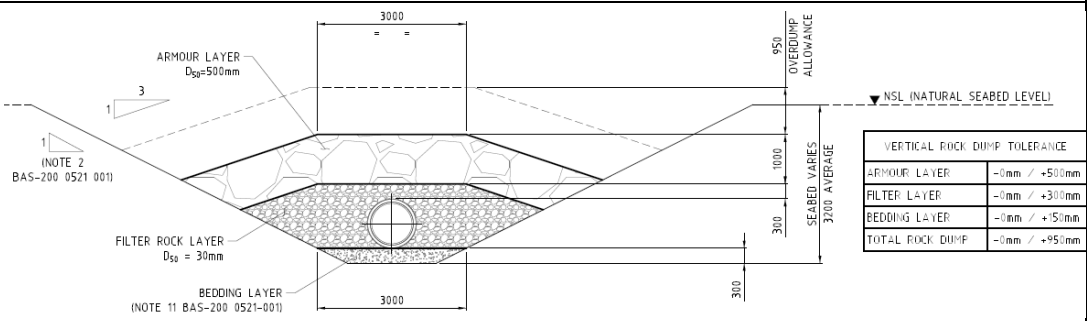
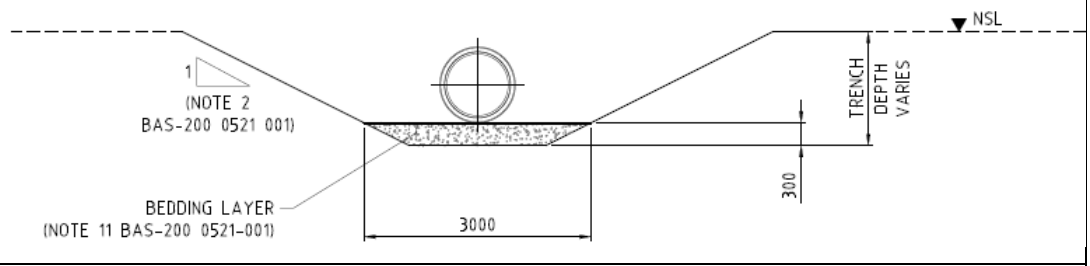
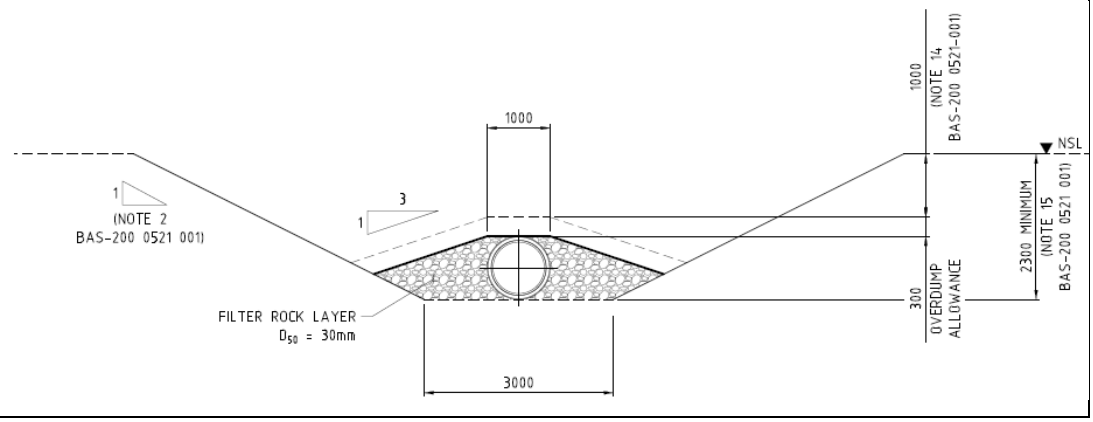
Target	Preliminary Significance Statement	Degree
Anti-submarine net mooring Trot 17	WWII was a significant period in Australian and Northern Territory history and the remnants of the boom defence system related directly to the defence of Darwin Harbour during this period. Such items are rare as only a small number of boom defences were established in Australia during WWII. The anti-submarine defences of Darwin during WWII may have been the largest boom defence network in the world at the time. The boom defence mooring clumps and chains are *in situ* on the seafloor and in a good state of preservation. This makes them rare not only in the Northern Territory but in a National Context.	High
Anti-submarine net mooring Trot 18	WWII was a significant period in Australian and Northern Territory history and the remnants of the boom defence system related directly to the defence of Darwin Harbour during this period. Such items are rare as only a small number of boom defences were established in Australia during WWII. The anti-submarine defences of Darwin during WWII may have been the largest boom defence network in the world at the time. The boom defence mooring clumps and chains are *in situ* on the seafloor and in a good state of preservation. In addition, the substitution of a conventional concrete mooring block with a repurposed ship's anchor increases the diagnostic value of this site by providing a unique display of adaptation and material scarcity during war time. The anchor itself is most likely of higher historic significance depending on its age and rarity. This makes them rare not only in the Northern Territory but in a National Context.	High
Target 174	The precise identity and nature of the object located at Target 174 cannot be conclusively determined based solely on a visual ROV survey. Further investigation would be needed to positively identify it within its historical context. However, if the object is a winch, windlass or bollard from a historic vessel its heritage significance could be substantially higher than if it was simply discarded. Target 174 is not believed to be part of a larger buried shipwreck.	Unknown, likely Low
MA_007	The precise identity and nature of the object located at Target MA_007 cannot be conclusively determined based solely on a visual ROV survey. Further investigation would be needed to positively identify it within its historical context. However, if the object is part of the wreckage of an historic aircraft or vessel, its heritage significance could be substantially higher than if it is discarded material.	Unknown, likely Minimal to Moderate
MA_001	The objects located at Target MA_001 are most likely the remains of a buoy mooring. Steel wire rope and steel wheel rims are commonly used as mooring devices across Australia, with numerous examples extant. The use of steel wire rope points to a likely late 20th century historical context. Not considered rare or culturally significant.	Minimal
NCL_SC_016	The precise identity and nature of the object located at Target NCL_SC_016 cannot be conclusively determined based solely on a visual ROV survey. Further investigation would be needed to positively identify it within its historical context. If the object is the remains of a 19th century telegraph cable, its cultural significance would be considerably higher than if it is modern material or discard.	Unknown, likely Minimal to Low

8.3 Potential impacts

Santos has advised that the pipeline will primarily be laid directly on the seabed. It is understood that trenching and placement of rock armour will be undertaken in several sections within Darwin Harbour (see Figure 103). The potential footprint of trenching has been identified as up to 40 m wide at top of batter due to use of cutter suction dredge. These sections include spans between KP 101 and 107, 110 and 114, 119 and 121, and 121 to terminus. It is understood, based on design documents provided by Santos, that five different

trenching configurations will be used, types A2, C1b, D1, D3, and E. Cross sections detailing the designs of the five trench types are shown in Table 14.

Table 14: Trench type cross section. NSL - natural seabed level.

Trench Type	Cross Section
A2	
C1b	
D1	
D3	
E	

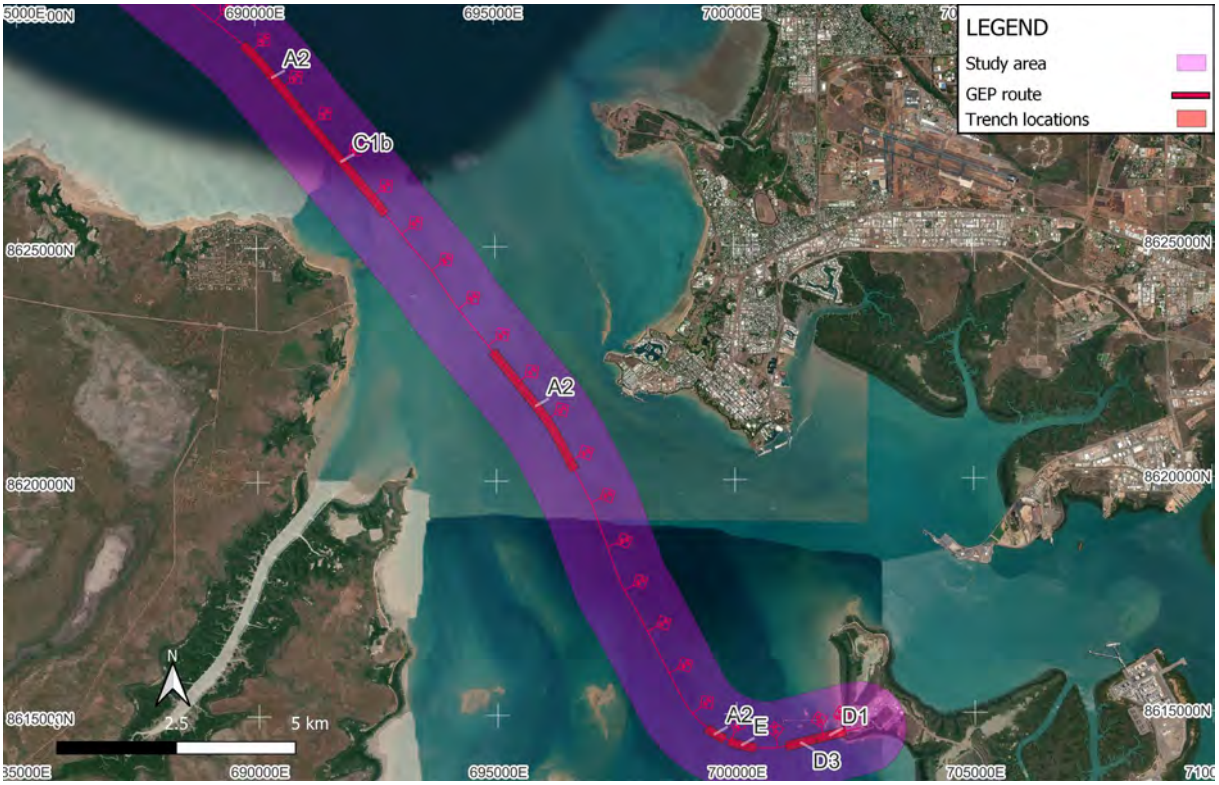


Figure 102: Map of proposed trenching locations with trench type labelled. (Polygons for trench locations are indicative of location only, not to scale by width).

One instance of underwater cultural heritage, Target MA_007, is within the trench extent overview. The target is located within the A2 trench between KP 111 and 113 (see Figure 104).

The laying of a pipe over a wreck site will not destroy such a site but will disturb or impact it. Such an activity, however, may damage and destabilise the site. It is understood that some sections will require the placement of mattresses to address spanning issues. Mattresses would cover parts of a site, which will protect it in the long term, but would negatively impact the site if it is not recorded before partial burial. If the wreck site is legally protected such disturbances could be considered unlawful without appropriate approvals under relevant heritage legislation. Additionally, Santos has identified a 900 m wide corridor on either side of the proposed GEP route between KP 91.5 and the terminus where work vessels may need to anchor. Anchor chains present a significant hazard to maritime cultural heritage sites within their deployment zone, as sweeping chains can damage or move archaeological sites and artefacts.

Within the anchoring corridor there are eight known shipwrecks (see Section 4.3.1, Table 2). Two of these, USAT *Mauna Loa* and USAT *Meigs,* fall under the protection of the NT *Heritage Act 2011* and may be protected under the USA *SMCA 2004.* The remaining six wrecks are under no legislative protection. Three objects of cultural heritage, inspected during ROV surveys, are also within the anchoring corridor, Targets 174, MA_007, and NCL_SC_016 (see Section 6.3.1). Additionally, the anti-submarine net mooring trots 16, 17, and 18 are within this corridor. It is highly likely, based on review of historical sources and geophysical survey data, that many of the remaining trots are also located within the anchoring corridor. In addition to trots 16, 17, and 18, an additional 90 geophysical targets within the anchoring corridor were identified as likely remains of anti-submarine net moorings (see Section 6.3.3).

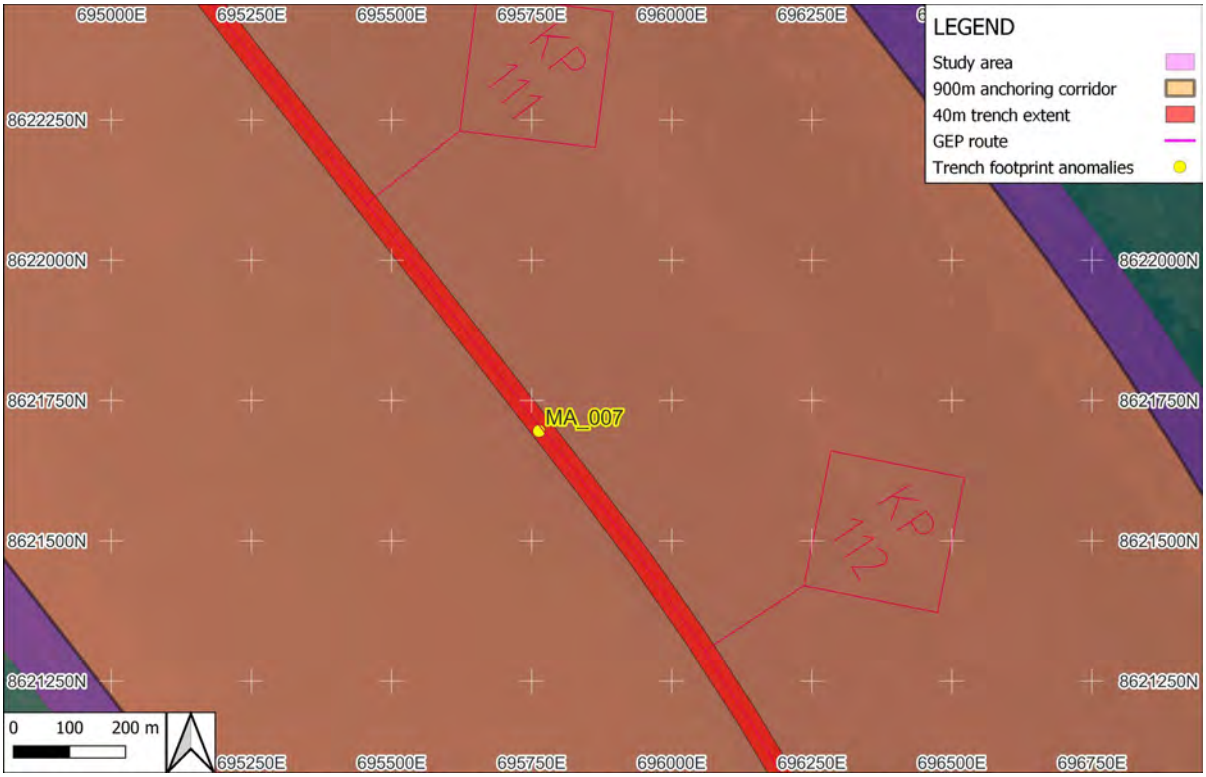


Figure 103: Underwater cultural heritage within trench extent overview.

A further 63 unverified geophysical anomalies, identified during geophysical survey data review but not inspected by ROV, are within the anchoring corridor (Figure 105). 18 of these targets were identified during review of Fugro survey data (see Section 6.3.1) and 45 were identified from review of the Geoscience Australia MBES dataset (see Section 6.3.2).

The location of these additional unverified anomalies, shipwrecks, and known cultural heritage is shown in Figure 105 and Table 15.

Figure 104: Location of unverified geophysical survey anomalies and other underwater cultural heritage within anchoring corridor.

Table 15: Unverified anomalies, shipwrecks, and known maritime cultural heritage within anchoring corridor.

Anomaly ID	Identification	Datum: GDA94 CRM: UTM Zone 52s		Distance from GEP (m)
		Easting	Northing	
138	Mound associated with anchor scar	686,407.37	8,632,159.33	59
141	Debris or rocks	690,574.96	8,628,606.67	137
191	Single object of high relief. Possible small boat.	696,438.36	8,620,800.13	73
192	Possible debris	696,253.89	8,620,643.48	147
196	Debris or rocks	696,859.94	8,619,902.39	53
210	Possible aircraft wreck or natural feature.	701,140.90	8,613,958.61	360
238	Possible scattered debris.	696,581.70	8,620,537.67	78
239	USAT *Mauna Loa*	697,710.77	8,617,774.90	90
240	Possible mooring block for anti-submarine defences	691,578.22	8,626,925.25	122
242	Steel wire rope and chain associated with anti-submarine defences. (boom net), UXO including mechanical fuses and fuse cones. (See Section 6.4)	691,589.94	8,626,799.20	186
243	Possible mooring block related to anti-submarine defences.	693,188.00	8,624,746.00	216
500	USAT *Meigs*	697,615.17	8,618,840.23	369
501	Medkhanun 3	695,875.84	8,619,850.01	847

Anomaly ID	Identification	Datum: GDA94 CRM: UTM Zone 52s		Distance from GEP (m)
		Easting	Northing	
502	*Ham Luong*	695,698.81	8,620,246.53	832
503	*Song Saigon*	695,794.02	8,620,287.72	728
504	John Holland Barge	695,778.93	8,620,381.31	700
505	*Mandorah Queen*	693,287.42	8,623,844.84	683
506	*NR Diemen*	691,938.35	8,625,657.51	642
573	Debris	692,508.78	8,625,489.01	295
574	WWII anti-sub boom net	691,574.41	8,626,791.47	209
575	Debris	691,518.71	8,626,801.77	245
576	Mound	689,856.12	8,628,847.08	268
577	Isolated object	689,412.76	8,629,288.62	263
578	Mound associated with trawl scar	685,439.11	8,632,096.37	603
579	Debris	689,314.84	8,630,473.13	592
580	Mound	689,842.70	8,630,171.05	691
581	Possible cable	691,692.88	8,627,659.36	431
582	Possible cable	692,233.25	8,626,819.69	320
583	Linear debris	692,918.80	8,626,550.93	682
584	Debris or boulder	692,936.90	8,626,417.56	613
588	Debris	693,982.49	8,624,331.38	165
585	Debris	694,508.35	8,624,088.70	472
586	Possible small boat or natural feature	694,770.88	8,624,269.65	791
587	Mooring block	695,753.15	8,623,106.77	852
589	Debris	696,110.51	8,621,995.74	452
590	Debris	696,133.59	8,621,994.69	470
591	Debris	696,472.78	8,621,975.02	727
592	Debris	696,535.45	8,621,187.11	345
593	Mooring block	696,548.46	8,621,272.90	399
594	Debris	697,090.00	8,620,464.24	513
595	Debris	697,563.09	8,620,256.32	845
597	Debris	698,035.82	8,617,894.98	443
598	Linear feature	697,030.36	8,617,864.23	504
599	Linear feature	697,055.70	8,617,918.12	462
600	Linear feature	697,036.34	8,618,057.64	434
601	Debris	696,815.85	8,619,144.52	286
602	Debris	696,751.52	8,619,156.36	343
603	Debris	696,112.03	8,619,639.40	729
604	Linear feature, log	696,043.52	8,619,624.92	797
605	Linear feature, log	696,000.91	8,619,629.09	833
606	Linear feature, log	696,032.94	8,619,598.74	818
607	Debris	696,362.60	8,619,654.65	497
609	Debris	696,003.49	8,621,145.27	132
610	Isolated object	695,614.51	8,621,498.95	244
611	Mooring block	693,064.64	8,624,298.00	599

Anomaly ID	Identification	Datum: GDA94 CRM: UTM Zone 52s		Distance from GEP (m)
		Easting	Northing	
612	Debris	693,132.32	8,624,265.69	568
620	Anti-submarine net mooring	692,571.44	8,624,809.47	663
621	Anti-submarine net mooring	692,539.74	8,624,860.74	656
622	Anti-submarine net mooring	692,523.80	8,624,892.44	649
623	Anti-submarine net mooring	692,599.70	8,624,754.58	674
624	Anti-submarine net mooring	692,709.75	8,624,594.89	685
625	Anti-submarine net mooring	692,769.99	8,624,467.63	716
626	Anti-submarine net mooring	692,749.61	8,624,525.87	696
627	Anti-submarine net mooring	692,726.33	8,624,548.70	700
628	Anti-submarine net mooring	692,147.90	8,624,971.06	898
629	Anti-submarine net mooring	692,431.95	8,624,717.81	829
630	Anti-submarine net mooring	692,412.02	8,624,771.61	812
631	Anti-submarine net mooring	692,453.33	8,624,625.24	869
632	Anti-submarine net mooring	692,922.97	8,624,532.76	556
633	Anti-submarine net mooring	692,914.46	8,624,593.08	525
634	Anti-submarine net mooring	692,897.79	8,624,648.33	504
635	Anti-submarine net mooring	692,876.05	8,624,702.14	488
636	Anti-submarine net mooring	692,763.55	8,624,903.58	453
637	Anti-submarine net mooring	692,729.14	8,624,950.23	452
638	Anti-submarine net mooring	692,816.54	8,624,826.14	459
639	Anti-submarine net mooring	693,066.90	8,624,638.82	377
640	Anti-submarine net mooring	693,040.27	8,624,691.00	365
641	Anti-submarine net mooring	693,020.88	8,624,746.07	347
642	Anti-submarine net mooring	692,944.62	8,625,014.99	242
643	Anti-submarine net mooring	692,919.53	8,625,081.20	221
644	Anti-submarine net mooring	692,908.66	8,625,150.86	187
645	Anti-submarine net mooring	692,905.94	8,625,190.98	164
646	Anti-submarine net mooring	693,039.04	8,625,225.45	38
647	Anti-submarine net mooring	693,058.79	8,625,182.69	49
648	Anti-submarine net mooring	693,076.54	8,625,127.44	69
649	Anti-submarine net mooring	693,093.03	8,625,071.10	90
650	Anti-submarine net mooring	693,205.80	8,624,728.36	213
651	Anti-submarine net mooring	693,234.87	8,624,680.26	222
652	Anti-submarine net mooring	693,144.21	8,624,841.13	191
653	Anti-submarine net mooring	693,182.07	8,624,784.25	196
654	Anti-submarine net mooring	693,311.23	8,624,817.58	75
655	Anti-submarine net mooring	693,293.93	8,624,874.10	53
656	Anti-submarine net mooring	693,197.83	8,625,161.77	48
657	Anti-submarine net mooring	693,162.23	8,625,272.64	88
658	Anti-submarine net mooring	693,173.46	8,625,217.02	63
659	Anti-submarine net mooring	693,400.45	8,624,893.93	42
660	Anti-submarine net mooring	693,420.92	8,624,841.76	24

Anomaly ID	Identification	Datum: GDA94 CRM: UTM Zone 52s		Distance from GEP (m)
		Easting	Northing	
661	Anti-submarine net mooring	693,376.72	8,624,944.02	56
662	Anti-submarine net mooring	693,282.43	8,625,202.62	140
663	Anti-submarine net mooring	693,307.79	8,625,145.38	125
664	Anti-submarine net mooring	693,254.26	8,625,282.33	167
665	Anti-submarine net mooring	693,362.50	8,625,014.22	88
666	Anti-submarine net mooring	693,460.95	8,625,089.13	211
667	Anti-submarine net mooring	693,555.33	8,624,959.96	203
668	Anti-submarine net mooring	693,650.62	8,624,848.92	204
669	Anti-submarine net mooring	693,506.97	8,624,814.32	72
670	Anti-submarine net mooring	693,465.48	8,624,923.37	111
671	Anti-submarine net mooring	693,643.69	8,624,929.98	251
672	Anti-submarine net mooring	693,469.78	8,625,242.93	313
673	Anti-submarine net mooring	693,711.60	8,625,070.97	394
674	Anti-submarine net mooring	694,135.50	8,625,135.19	759
675	Anti-submarine net mooring	694,161.68	8,625,283.10	875
676	Anti-submarine net mooring	694,183.69	8,625,228.03	856
677	Anti-submarine net mooring	694,250.36	8,625,094.43	821
678	Anti-submarine net mooring	693,923.28	8,625,184.46	629
679	Anti-submarine net mooring	693,952.90	8,625,141.07	624
680	Anti-submarine net mooring	693,970.93	8,625,083.92	601
681	Anti-submarine net mooring	693,751.64	8,625,475.17	678
682	Anti-submarine net mooring	693,775.01	8,625,422.23	664
683	Anti-submarine net mooring	693,794.64	8,625,355.29	638
684	Anti-submarine net mooring	693,902.95	8,625,554.38	846
685	Anti-submarine net mooring	694,101.63	8,625,224.18	791
686	Anti-submarine net mooring	693,979.35	8,625,516.11	883
687	Anti-submarine net mooring	693,951.72	8,625,500.98	852
688	Anti-submarine net mooring	693,595.12	8,625,397.09	506
689	Anti-submarine net mooring	693,625.83	8,625,262.22	448
690	Anti-submarine net mooring	693,861.92	8,624,914.00	408
691	Anti-submarine net mooring	694,235.64	8,625,020.33	763
692	Anti-submarine net mooring	694,004.85	8,624,910.74	515
693	Anti-submarine net mooring	693,790.27	8,625,076.31	458
694	Anti-submarine net mooring	692,680.70	8,625,066.80	418
695	Anti-submarine net mooring	692,486.05	8,624,972.60	630
696	Anti-submarine net mooring	692,274.19	8,624,850.32	872
697	Anti-submarine net mooring	692,370.93	8,624,932.20	746
698	Anti-submarine net mooring	692,376.54	8,624,652.46	913
699	Anti-submarine net mooring	693,479.77	8,625,162.13	271
700	Anti-submarine net mooring	693,373.52	8,625,219.83	223
701	Anti-submarine net mooring	692,476.81	8,624,552.19	895
702	Anti-submarine net mooring	692,545.01	8,624,451.33	903

Anomaly ID	Identification	Datum: GDA94 CRM: UTM Zone 52s		Distance from GEP (m)
		Easting	Northing	
703	Anti-submarine net mooring	692,536.68	8,624,530.67	861
704	Anti-submarine net mooring	692,512.14	8,624,583.21	848
705	Anti-submarine net mooring	692,731.65	8,624,460.66	750
706	Anti-submarine net mooring	693,612.40	8,625,501.30	584
707	Anti-submarine net mooring	693,639.40	8,625,450.30	414
708	Anti-submarine net mooring	693,667.30	8,625,396.10	435
709	Anti-submarine net mooring	693,801.20	8,625,027.90	562
710	Anti-submarine net mooring	693,812.30	8,624,981.60	576
MA_028	Inferred Cable	693,130.70	8,624,923.90	151
MA_031	Inferred Buried Debris	698,180.90	8,616,372.60	146
MA_037	Icthys GEP	701,335.50	8,613,704.20	651

Four geophysical anomalies were identified within 10m of the proposed GEP route, ID: 142, 175, 245, and 246. Targets 142, 175, 245, and 246 were observed during ROV surveys and determined to be natural. An additional six geophysical anomalies were identified within 50m of the proposed GEP route, ID: 166, 174, 233, 241, 244, and 247. Targets 166 and 244 were identified by ROV survey as part of Trot 18, while 233, 241, and 247 were identified to be natural features by ROV. Target 174 was identified as cultural in origin.

The ROV survey identified three anti-submarine net mooring trots, Trots 16, 17, and 18. Trot 17 directly crosses the path of the proposed GEP route. The northern most clump of Trot 16, identified as a repurposed ship's anchor, is located approximately 37m from the proposed GEP route, and the southernmost chain section of Trot 18 is located 32m from the proposed GEP route. The location of Clump 1, Trot 18, if still extant would likely be located within 25m of the proposed route.

In addition to the anti-submarine net trots, four isolated instances of cultural heritage were observed during ROV surveys. Target MA_007 is located 6m from the proposed GEP route. Targets 174, MA_001, and NCL_SC_016 are located 15-35m from the proposed GEP route.

Table 16: Targets and anomalies located within 50m of proposed GEP route.

Anomaly/Target ID	Target surveyed by ROV	Cultural/Natural	Within 10m of GEP route
Trot 16 (incl. Targets 166, NCL_SC_017, 018, and 019)	Yes	Cultural	No
Trot 17 (incl. Targets 165, 167, MA_011, NCL_SC_020, 021, 022, 023, 024, and 025)	Yes	Cultural	Yes
Trot 18 (incl. Targets 164, 167, 244, and NCL_SC_026)	Yes	Cultural	No
142	Yes	Natural	Yes
174	Yes	Cultural	Yes
175	Yes	Natural	Yes
233	Yes	Natural	No
241	Yes	Natural	No
245	Yes	Natural	Yes
246	Yes	Natural	Yes
247	Yes	Natural	No

Anomaly/Target ID	Target surveyed by ROV	Cultural/Natural	Within 10m of GEP route
MA_001	Yes	Cultural	No
MA_007	Yes	Cultural	Yes
NCL_SC_016	Yes	Cultural	No
NCL_SC_031	Yes	Natural	No

8.4 Legislative compliance

Certain objects may be protected under various local, state, and Commonwealth heritage acts, depending on their historical contexts and assessed heritage significance. Protected objects may require permits to be obtained before they may be disturbed. Noncompliance with heritage legislation may result in fines or criminal charges.

None of the cultural objects identified by ROV survey would be protected under the *NT Heritage Act 2011.*

The *UCH 2018* automatically protects shipwrecks over 75 years of age within all Australian waters (incorporating Territory internal and Commonwealth waters, see section 3.1), including articles associated with these shipwrecks. Although unlikely, if the objects located at Targets 174 and MA_007 are historic ship wreckage, over 75 years old, a permit may be required to disturb them.

The *UCH 2018* automatically protects aircraft wrecks over 75 years of age within Commonwealth waters. This excludes internal state waters, including Darwin Harbour and portions of Beagle Gulf. If the objects located at Target MA_007 are aircraft wreckage, it would **not** be protected under this act.

Installations including maritime infrastructure, such as the WWII anti-submarine boom net moorings and historic telegraph cables, are **not** automatically protected under the *UCH 2018*. Currently, the historic submarine telegraph landings are afforded statutory protection and are listed on the NT Heritage Register. The anti-submarine net moorings are not under statutory protection. Historic maritime infrastructure, especially infrastructure from the 19th century or associated with WWII, is likely of heritage interest and may rate as high heritage significance. Previously, the anti-submarine net moorings have been rated as having 'High' heritage significance.[119]

8.5 Mitigation measures

Mitigation for heritage objects and sites depends on the likelihood of potential impacts as well as the degree of heritage significance. Several of the targets identified as cultural during ROV surveys cannot have their heritage significance assessed due to lack of information. For cultural heritage sites, objects, and unverified anomalies likely to be impacted by proposed works, the first preference for mitigation is avoidance. If not possible, a more detailed investigation may be needed to conclusively identify their historical context and condition, to inform a heritage management plan with specific alternative mitigation measures. Such a management plan would only need to be adopted for those objects deemed likely to be impacted.

Cosmos Archaeology has previously completed impact assessments for anti-submarine net mooring trots that were likely to be impacted by the installation of the Icthys GEP.[120] This

[119] **Cosmos Archaeology, 2012,** *Icthys Project Darwin Harbour, East Arm Gas Export Pipeline: Assessment of Heritage Impact of 7 side scan targets,* Report prepared for Tek Ventures Pty Ltd.
[120] Op. Cit., **Cosmos Archaeology, 2012.**

assessment rated the trots and clump weights as **High** significance, and **Certain** to be impacted by installation of the GEP. Recommended mitigation was as follows:

> *Prior to disturbance undertake video recording of the concrete boom defence mooring blocks and chain. The chain is to be followed to either side of the block to see where they end. The distance between the blocks is expected to range from 30 to 60 m.*
>
> *Each block should be placed in an upright position with the chain laid alongside close – without the possibility of causing a hindrance – to the proposed pipeline route.*
>
> *Once the blocks and chain are in place, video footage, a site map and description, is to be obtained, preferably by a maritime archaeologist.*[121]

For this project, it was determined sufficient that the mooring trots were recorded fully *in situ* before being moved out of the path of the GEP. Once relocated, the trot was recorded again, and its location was documented. The proposed Barossa GEP route directly crosses the path of mooring Trot 17, identified during ROV survey Heritage Transect 1. Ideally, the proposed GEP alignment could be altered to avoid anti-submarine net mooring Trot 17 and Target MA_007 however relocation of chain and mooring blocks from this trot as done for theINPEX project would be acceptable if the GEP route cannot be changed to avoid impacting this site.

All other anomalies, targets, and surveyed cultural heritage is considered unlikely to be impacted by the direct action of GEP installation. However, unassessed cultural heritage, identified significant cultural heritage, and unverified anomalies should be avoided during the works, including during ship anchoring. Establishment of no-anchoring zones around these will help ensure significant maritime cultural heritage is not adversely impacted.

If the identified cultural material cannot be avoided, then a detailed heritage impact assessment will need to be conducted, consistent with the NT Heritage Branch Archaeological Scope of Works.[122] The impact assessment will likely require further inspections, diving would produce best results, to conclusively assess the significance of Target MA_007. A work class ROV may assist with accurate measurements and precise positioning but would not allow the tactile investigation that a diver could do. This would inform a Maritime Heritage Management Plan, which would include specific mitigation measures and management recommendations for each target, such as, but not confined to, archaeological recording, clearance, removal, and/or recovery. For example, any clearance of cultural material from the seabed could be recorded by a maritime archaeologist on-site. For the INPEX project this involved maritime archaeologists with suitable diving qualifications embedded with the commercial dive teams.

It is recommended that any further remote sensing undertaken for the proposed GEP should be reviewed by a qualified maritime archaeologist.

Finally, there is always the possibility of unexpected finds being made during the construction phase. Prior to the commencement of construction an Unexpected Maritime Archaeological Finds Protocol should be prepared by a suitably qualified maritime archaeologist. If a Maritime Heritage Management Plan is deemed necessary, this would be a component of such a plan. This protocol should include:

- Unexpected finds, stop work triggers and notification procedures
- Heritage induction for contractors
- Recording and reporting methods and procedures

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[121] *Op. Cit.* **Cosmos Archaeology, 2012:**27.
[122] **NT Heritage Branch, 2021,** Archaeological Scope of Works: Gas export pipeline Barossa gas field to Middle Arm, Darwin Harbour.

- Artefact collection and retention policies

9 CONCLUSION

9.1 Summary of findings

A review of historical sources, databases and marine geophysical information has found that;

- Within the study area, Larrakia and Tiwi people conducted maritime travel and subsistence activities – likely concentrated in coastal environments. Macassan trepang fishing and trade occurred throughout the 18th to early 20th centuries.
- British exploration and surveying began in the early 19th century, following which a wide range of colonial shipping including Government and commercial cargo and passenger transport, fishing and pearling industry trade and transport, and recreational shipping occurred, from the establishment of colonial settlement in Darwin in 1860s to present.
- In the 1870s and 1880s three subsea telegraph cables were laid.
- Quarantine and leper station transport and service supply were established in Middle Arm throughout late 19th to early 20th century.
- The study area saw significant military action during World War II, including air and sea combat between Allied and Japanese forces, which resulted in the sinking of numerous ships and aircraft within Beagle Gulf and Darwin Harbour.
- The entrance to Darwin Harbour was the location of numerous anti-submarine defences during WWII, including anti-submarine boom nets and indicator loops, some of which have been located and recorded by previous CA surveys.
- There are seventeen known, located shipwrecks within the study area, along with five known locations of UXO and six instances of maritime infrastructure (including the above-mentioned anti-submarine defences and telegraph cables). Four of five instances of UXO are related to WWII shipwrecks and are protected by statutory legislation. One instance, Contact 2, was identified and disposed of during INPEX heritage investigations. See Section 4.3.5, Table 4 for details and locations.
- There are 29 known but unlocated shipwrecks and 25 known but unlocated aircraft wrecks recorded to have sunk within the vicinity of the study area. Any of these could potentially be located within the study area.
- The remains of these vessels, and their contents and fittings, are automatically protected under the Cwlth *Underwater Cultural Heritage Act 2018*. Remains within the TSB are protected under the NT *Heritage Act 2011,* and United States military shipwrecks and aircraft wrecks are protected under the US *Sunken Military Craft Act 2004.*
- Side scan sonar, magnetometer, and MBES data from a marine geophysical survey conducted by Fugro in 2022 was reviewed, as well as MBES data published by Geosciences Australia.
- Clear evidence of eight shipwrecks was identified within the study area, and no aircraft wrecks were identified. Two of these shipwrecks, USAT *Meigs* and USAT *Mauna Loa* are under statutory heritage protection. Furthermore, there is a possibility that anomaly ID: 210 could potentially be aircraft remains.
- Thirty-nine sonar, MBES, and magnetometer contacts were identified by CA within the Fugro geophysical survey corridor as being probably cultural and hence of potential cultural heritage significance.

- An additional 133 anomalies were identified by CA from publicly available MBES data within the anchoring corridor, but outside of the Fugro geophysical survey corridor. These 133 anomalies were identified as being probably cultural and hence of potential cultural heritage significance. Ninety of these targets were identified as likely WWII anti-submarine net mooring devices located between KP 107 and KP 108.
- These anomalies could be remains of anti-submarine defences, 19th century telegraph cables, possible aircraft wreckage, debris fields, or isolated instances of debris and/or discard.
- An ROV survey was conducted between 6-8 June 2022 on 16 targets identified by the geophysical survey review as being within 50m of the proposed GEP route. Survey included three dive transects conducted on the likely remains of WWII anti-submarine net moorings.
- 11 anti-submarine net moorings, connected by heavy grade chain were identified during ROV survey, located between KP 107 and KP 108. These moorings and chain represent three “trots”, or lines of moorings, used to anchor WWII anti-submarine nets. Based on historic chart overlays, it is believed that heritage transects 1, 2, and 3 corresponded to Trots 17, 16, and 18, respectively. 10 moorings were conventional trapezoidal concrete weights, while one mooring, Target 164, was identified as a large ship’s anchor, repurposed for use as mooring.
- In addition to the anti-submarine net moorings, a further 10 isolated geophysical survey targets were inspected during ROV surveys. Six of these (Targets NCL_SC_002, NCL_SC_031, 142, 175, 241, and 245) were determined to be natural features. The other four targets (Targets MA_001, MA_007; Target NCL_SC_016; Target 174) were determined to be cultural in origin.
- Due to the limitations of a visual ROV survey, the identity of Targets 174, MA_007, and NCL_SC_016 could not be conclusively confirmed. Therefore, their heritage significance, as well as the significance of any other uninspected geophysical anomalies, cannot be properly assessed without further investigation.
- The proposed GEP installation will likely impact the central trot, Trot 17, identified by ROV heritage transect 1, and MA_007. Additionally, vessel anchoring as part of proposed works could impact any anomalies or cultural heritage within a 900 m corridor on either side of the GEP route. Therefore, the establishment of no-anchoring zones around uninspected anomalies and cultural heritage objects and sites within this corridor is recommended. A 15 m radius is considered appropriate for isolated anomalies, while a radius of 50 m is generally considered acceptable for larger sites, such as shipwrecks or aircraft wrecks. It is recommended that a buffer of 15 m is also afforded to the linear space between lines of potential anti-submarine net mooring trots to protect the chain in between moorings.
- If Trot 17 and Target MA_007 cannot be avoided, then a detailed heritage impact assessment will need to be conducted, consistent with the NT Heritage Branch Archaeological Scope of Works. Likewise, if no-anchoring zones cannot be established around other cultural heritage or unverified anomalies within the 900 m anchoring corridor, these will need to be assessed as well. Depending on the identity and historical significance of said objects, permits to disturb may be required under the *UCH 2018* Act.
- It is recommended that if further remote sensing surveys of the proposed GEP are undertaken, the additional survey data should be reviewed by a qualified maritime archaeologist.

- In the event of significant maritime archaeological remains being discovered during the construction phase, an Unexpected Maritime Archaeological Finds Protocol to responsibly manage such finds should be prepared and implemented.

9.2 Recommendations

Recommendation 1 ***If feasible, the proposed GEP alignment should be altered to avoid the WWII anti-submarine net mooring Trot 17 as well as cultural heritage objects identified at Target MA_007.***

Recommendation 2 ***If potentially cultural anomalies objects identified in this assessment are likely to be impacted, undertake a detailed heritage impact assessment by a qualified maritime archaeologist.***

If the identified anomalies cannot be avoided and are likely to be impacted, then a detailed heritage impact assessment would need to be conducted, consistent with the NT Heritage Branch Archaeological Scope of Works.[123] The impact assessment may include further ROV and/or dive inspections to assess significance of the anomalies. This would inform a Maritime Heritage Management Plan, which would include specific mitigation measures – such as relocation of certain objects - and management recommendations.

Recommendation 3 ***Establish no-anchoring zones around shipwreck locations, the anti-submarine net moorings, and unverified geophysical anomalies within the anchoring corridor.***

50 m radius for larger sites such as shipwrecks, 15 m for isolated anomalies and anti-sub net moorings/chains.

Review of Geosciences Australia MBES data with full coverage of Darwin Harbour from the proposed GEP terminus to KP 85 has identified eight shipwrecks within the 900 m anchoring corridor. Two of these wrecks, USAT *Meigs* and USAT *Mauna Loa,* are under statutory heritage protection. No-anchoring zones should be established around all eight wrecks, as well as the anti-submarine net corridor and any unverified geophysical anomalies. This information should be included in a Maritime Heritage Management Plan.

Recommendation 4 ***If additional remote sensing data is collected for the proposed GEP it should be reviewed by a qualified maritime archaeologist.***

Recommendation 5 ***Prepare and implement an Unexpected Maritime Archaeological Finds Protocol.***

Prior to the commencement of the construction phase an Unexpected Maritime Archaeological Finds Protocol should be prepared by a suitably qualified maritime archaeologist. This protocol should include:

- *Unexpected finds, stop work triggers and notification procedures*
- *Heritage induction for contractors*

[123] **NT Heritage Branch, 2021,** Archaeological Scope of Works: Gas export pipeline Barossa gas field to Middle Arm, Darwin Harbour.

- *Recording and reporting methods and procedures*
- *Artefact collection and retention policies*

This protocol would form a component of the Maritime Heritage Management Plan referenced in Recommendation 2.

Recommendation 6 Review of this assessment if proposed alignment of pipeline changes.

This review should be undertaken by a suitably qualified maritime archaeologist.

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10 ANNEX A: ROV SURVEY TECHNICAL MEMO

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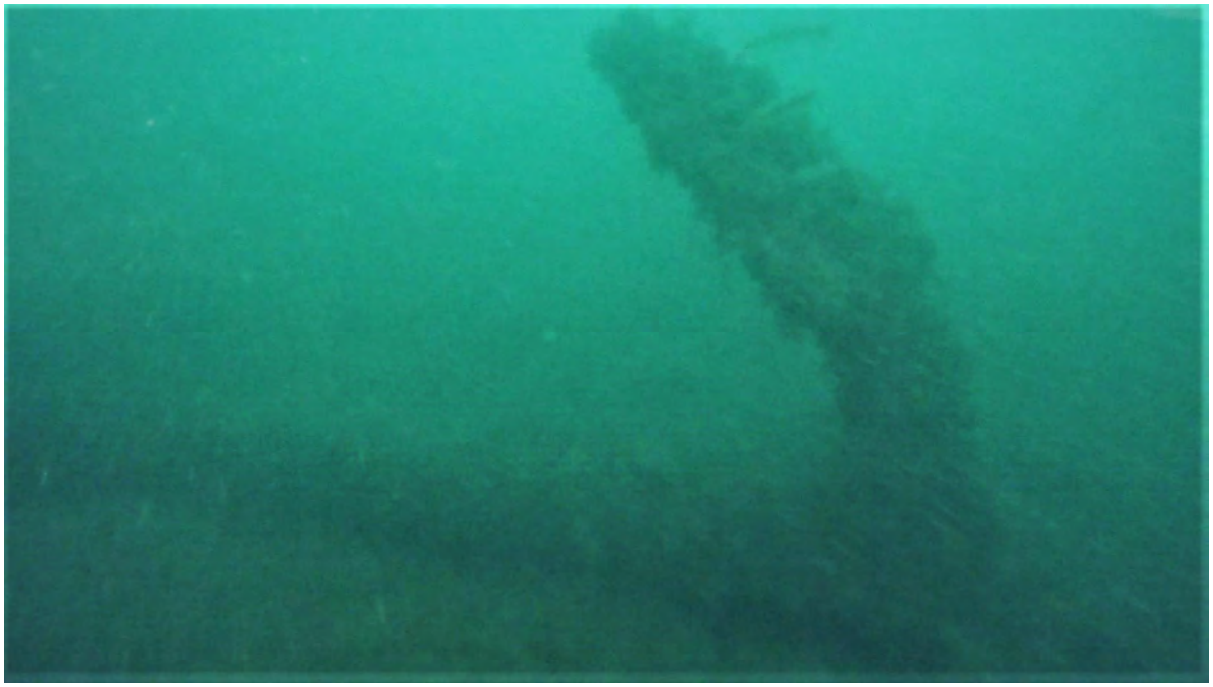
Barossa Pipeline



Maritime Cultural Heritage

ROV Survey

June 2022

Darwin Harbour

NT

June 2022

Barossa Pipeline
Maritime Cultural Heritage ROV Survey June 2022

Prepared for:

Santos Pty Ltd

By:

Connor McBrian

June 2022

Cosmos Archaeology Job Number J21/22

Cover Image: *Anchor located during survey.*

Revision	Description	Date	Originator	Reviewer	Approver
V1	DRAFT Darwin Harbour ROV Survey	28-06-2022	CM		

Abbreviations

CA	Cosmos Archaeology	MBES	Multi-beam echosounder
GPS	Global Positioning System	ROV	Remote operated vehicle
m	Metres	SSS	Side Scan Sonar

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

The Santos (Barossa) Gas Export Pipeline is a proposed installation a gas export pipeline (GEP) off the northwest coast of the Northern Territory (NT). The proposed GEP begins at the Barossa gas field, north of the Tiwi Islands, and extends south to feed the Darwin LNG plant, located in Middle Arm, Darwin Harbour. The first proposed route is a GEP from the Barossa gas field to a tie in point into the existing Bayu-Undan to Darwin pipeline, tying in at a point southwest of Bathurst Island. The second proposal is to extend the GEP from Barossa to the Darwin LNG plant. This second proposal traverses through the entrance of Darwin Harbour directly to the Darwin LNG at Middle Arm.

Figure 1: Proposed route of the Barossa GEP in Beagle Gulf and Darwin Harbour.

As part of environmental and heritage impact assessments, a suite of geophysical surveys were conducted including multi-beam bathymetry (MBES), side scan sonar (SSS), and magnetometer surveys to identify locations of potential cultural material. Review of the available geophysical survey identified forty targets of possible cultural origin. Sixteen of these targets were located within 50m of the proposed GEP route and were shortlisted for visual survey to confirm their identity and origin. The sixteen chosen targets were inspected over the course of three days between 6-8 June 2022.

1.1.1 *Objectives*

The objectives of this dive survey were to:

> *Visually inspect targets identified through geophysical data for their potential cultural heritage significance and recommend measures to reduce impacts to their cultural heritage values.*

2 MARITIME ARCHAEOLOGICAL DIVE SURVEY

2.1 Dates and Personnel

The dive survey was carried out over three days: 6-9 June 2022. Connor McBrian from Cosmos Archaeology was the maritime archaeologist supervising the heritage inspections. ROV support was provided by FUGRO in the form of two ROVs, while boat and marine services were supplied by Bhagwan Marine. In addition to this, a representative from Santos Pty Ltd was on board to supervise surveys along with an environmental specialist from RPS. ROV operations were run and supervised by FUGRO. Personnel involved during the inspection are listed in Table 1.

Table 1: Dive inspection personnel

Name	Title	Company
Connor McBrian	Maritime Archaeologist	Cosmos Archaeology
James Clarke	Survey Party Chief	Fugro
Luke Eller	ROV Pilot / Tech	Fugro
Simon Bochow	Skipper	Bhagwan Marine
Pete Ivicevich	Client Representative	Santos NA Barossa Pty Ltd
Garnet Hooper	Environmental Specialist	RPS Group

2.2 Weather and Tide Conditions

Weather and tide conditions are factors when operating an ROV within the study area. Tides were especially considered in relation to the current and visibility, which could limit ROV operations. As much as possible, dives were conducted at slack tides to avoid excessive current and drift. The tide conditions during the surveys are provided in Table 2 and weather conditions during the survey are provided in Table 3.

Table 2: Tides for the days of survey.

06-06-2022	Time	0341	1016	1612	2147
	Height (m LAT)	2.3	6.1	3.3	5.2
07-06-2022	Time	0430	1102	1721	2300
	Height (m LAT)	2.6	5.8	3.4	4.9
08-06-2022	Time	0534	1200	1847	0031 (next day)
	Height (m LAT)	3.0	5.7	3.3	4.9

Note: For ease of identifying high and low tide, low tide is blue and high tide is red.

Table 3: Rain and wind conditions for the day previous to the dive inspections and the days of the inspection.

Date	Rain (mm)	Wind 09:00 (km/h)	Wind 15:00 (km/h)
05-06-2022	0.0	13 ESE	17 N
06-06-2022	0.0	9 SE	13 NW
07-06-2022	0.0	11 E	17 ENE
08-06-2022	0.0	20 E	17 ESE

2.3 Conduct of Survey

The underwater survey was conducted with the use of an ROV, operated by crew from FUGRO under the direction of the maritime archaeologist. Certain features, such as the anti-submarine net mooring trots were surveyed along transects following the features in a linear pattern. Isolated targets were targeted by dropping a clump weight with a buoy attached on the target coordinates while the vessel was moving, and then following the buoy line to the seabed with the ROV once the vessel was anchored. Once on the bottom, the ROV was manoeuvred in cross shaped search patterns using the clump weight as a reference point.

The ROV was battery powered and controlled remotely by the pilot from inside the survey vessel cabin. Because the ROV was not equipped with transponders or any location fixing devices, the exact location of the ROV had to be estimated based on identifiable features on the seabed that could be compared to MBES data, course headings, and position relative to the *Warrigal.*

2.3.1 Target inspection dives

The targeted inspection dives required the ROV pilot and maritime archaeologist to locate and identify seafloor anomalies from existing geophysical data. GPS locations of targets derived from MBES data was used to locate the potential targets and manoeuvre the *Warrigal* into position.

Targets identified within the location of WWII submarine netting were surveyed along three transects, as these consisted of large concrete clump weights connected by thick chain. The chain was easily visible above the seabed, and provided a reliable way of tracking and locating the ROV as it completed the linear transects.

From review of the geophysical survey data, 15 targets were identified for visual investigation, based on their assessed likelihood of being cultural material, and their proximity (within 50m) of the proposed GEP route. These targets were given a priority status for the targeted inspections. These were:

- A = top priority
    - Images appear to be cultural and representative of a ‘site’ such as a small wreck.
- B = secondary
    - Images appear to be cultural but are representative of an individual object, or discard and less likely to constitute a site.
- C = tertiary
    - Targets unlikely to be cultural, or known to be culturally insignificant.

2.4 Findings of the Diving Survey

For organisational purposes, the following list of targets is separated into the three heritage transects, T1, T2, and T3, used to record the anti-submarine net moorings, and isolated targets surveyed individually.

2.4.1 *Heritage Transect 1*

T1 followed a line of concrete clump weights, connected by heavy chain, that were identified as the moorings for the WWII anti-submarine net. This transect was located between KP 107 and KP 108, and ran NNW from a target just south of 165, located at 693309.60 m E, 8624815.60 m N to target 244, located at 693195.40 m E, 8625165.60 m N. The transect continued at the same heading north from Target 244 to a final concrete clump weight located at 693162.30 m E, 8625272.50 m N.

Along this transect, attempts were made to locate two isolated anomalies, Targets 246 and 247, without success.

7 dives were attempted on T1, of which one (T1_5) had to be aborted due to currents overpowering the capabilities of the ROV.

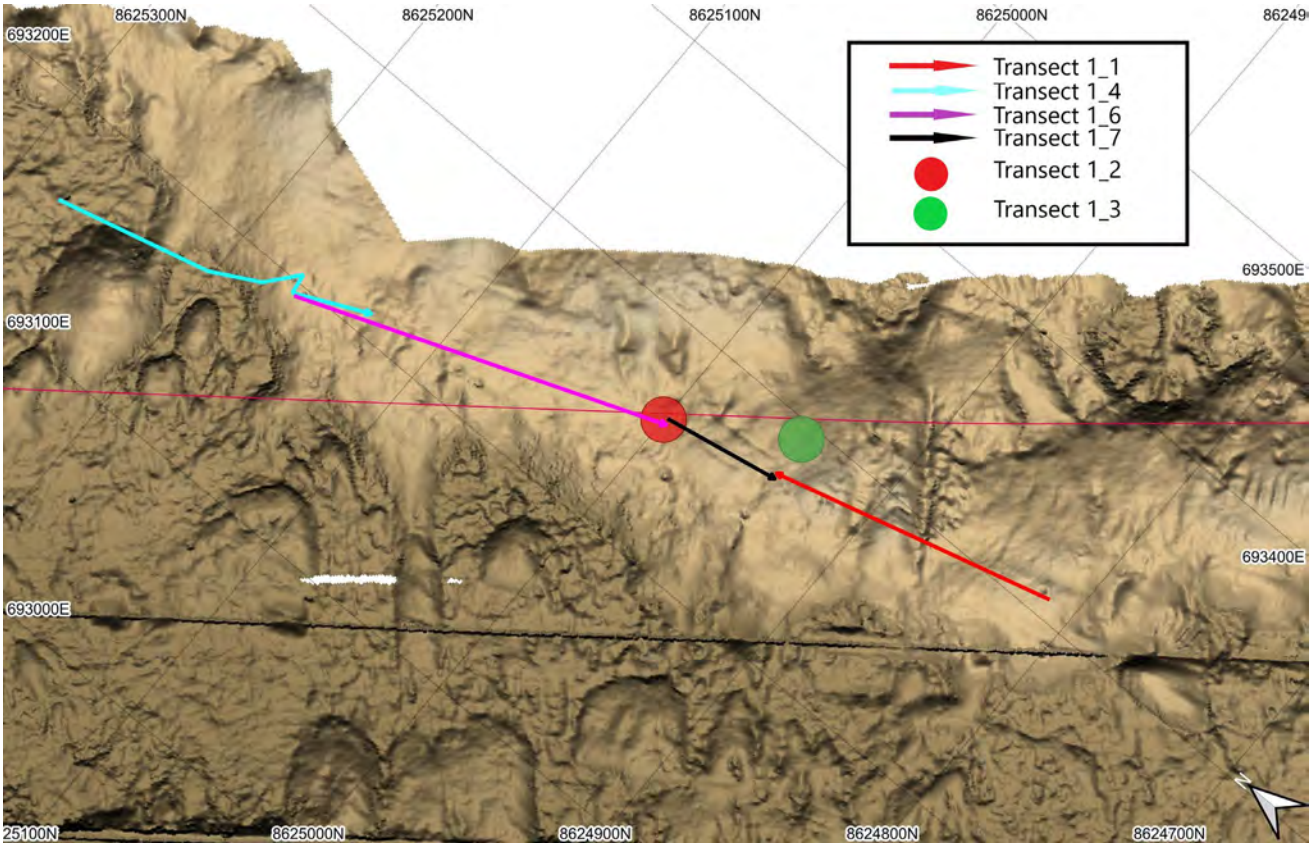


Figure 2: Dive locations for Heritage Transect 1.

The datum for all coordinates for the targets is GDA94.

2.4.1.1 T1_1

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Depth	Distance from GEP route (m)
3	693309.76	8624814.97	Anti-submarine net moorings. Large concrete trapezoidal mooring blocks connected by lengths of thick chain.	Width: 0.00 Height: 0.00 Length: 1.54 Shadow: 0.00	29 m	Variable, from 25 to 80

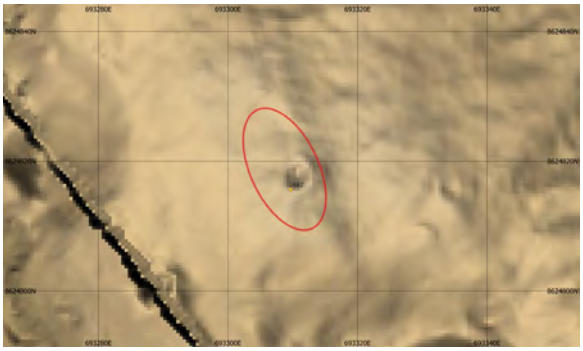


Figure 3: Target 167 MBES image.

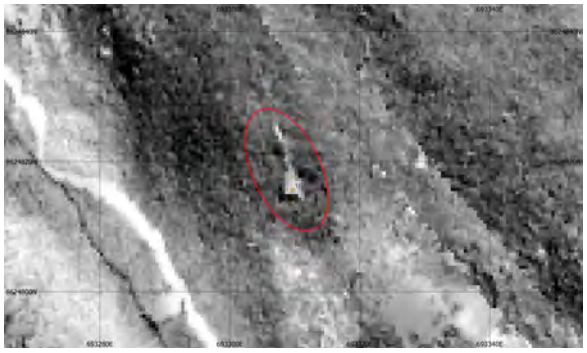


Figure 4: Target 167 SSS image.

Inspection details for T1_1		
Date: 06-06-2022	Method: ROV	Tide: Slack
Distance and direction: 125 m, 345° NNW		
Swim start (min): 1027	Swim end (min): 1138	Total time (min): 71
Depth: 14.2 m	Water visibility: 1 m	Seabed visibility: Poor

Target description: The seabed within the search area was generally rocky with a layer of easily disturbed sediment and large amount of marine growth, including soft corals. Transect 1_1 began by locating Target 167 and following a length of chain extending from Target 167 at a heading of 345° NNW for approximately 125m. Despite low visibility, target 167 was quickly located through the use of the ROV's sonar. 167 was determined to be a large concrete mooring block, used as part of the anchoring system for the anti-submarine nets installed during WWII (Figure 7). A cable connected to the southern end of the block appeared to anchor to the seafloor, while length of thick chain (Figure 8) was attached to the northern face of the concrete block and connected 167 to a twin set of mooring blocks, located at 693294 m E 8624875 m N (Target ID: NCL_SC_020; Figure 9 and Figure 10). Another section of the same chain continued further north from the twin blocks before disappearing into the seabed ~30m further NNW. The ROV's tether ran out before the next mooring block could be positively located.

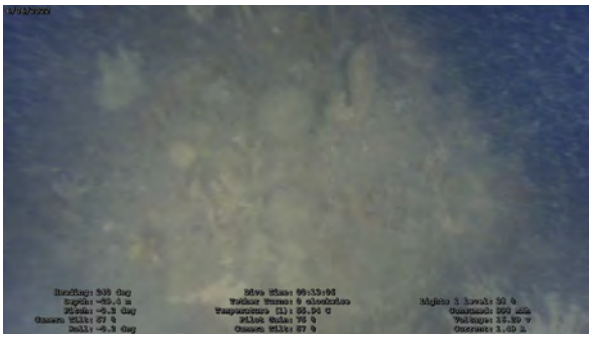


Figure 5: Screen grab of Target 167, concrete anti-sub net mooring block. (Video 2022-06-06_10.27.18; 11:17).

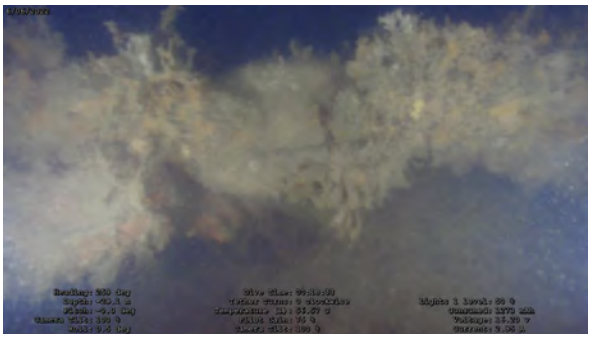


Figure 6: Screen grab of chain leading NNW from Target 167. (Video 2022-06-06_10.27.18; 16:47).

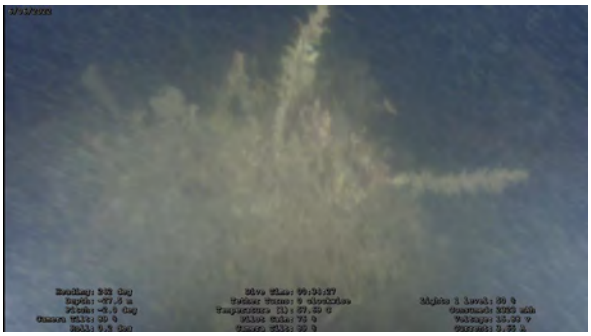


Figure 7: Screen grab of NCL_SC_020, first concrete block. (Video 2022-06-06_10.58.29; 01:29).

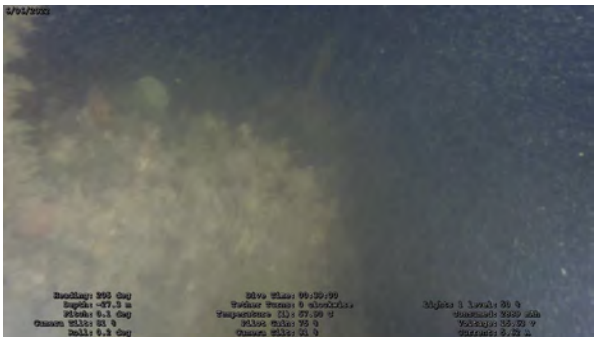


Figure 8: Screen grab of NCL_SC_020, second concrete block. (Video 2022-06-06_10.58.29; 06:01).

2.4.1.2 T1_2

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
4	693286.00	8624946.00	Target 247, aka MA_003	Width: 0.00 Height: 0.00 Length: 7.96 Shadow: 0.00	0	28 m

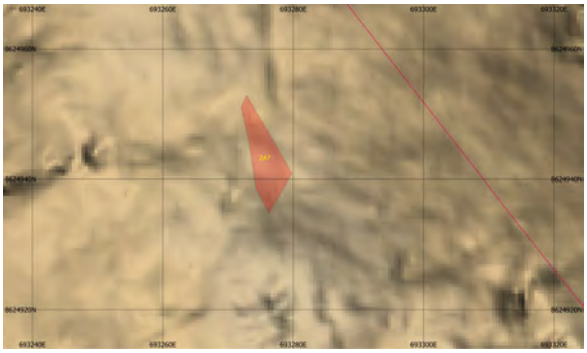


Figure 9: Target 247 MBES image.

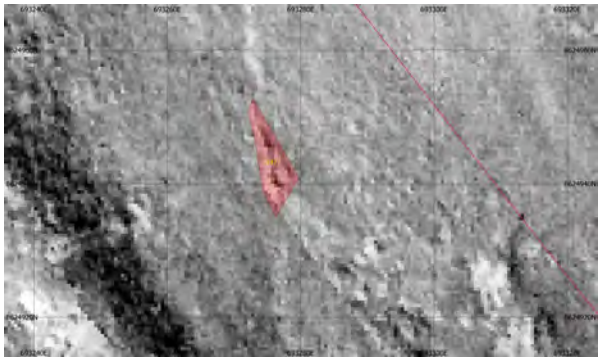


Figure 10: Target 247 SSS image.

Inspection details for T1_2		
Date: 06-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Circular search 10 m		
Swim start (min): 1215	Swim end (min): 1238	Total time (min): 13
Depth: 28 m	Water visibility: 0 m – 1 m	Seabed visibility: Poor

Target description: This dive was an attempt to locate Target 247, possibly associated with magnetometer target MA_003. In addition to locating 247, an attempt was made to locate the anti-sub net chain that disappeared into the seabed at the end of transect T1_1. The seabed in the search area was similar to Transect T1_1 with fine grain sandy sediment as well as scattered rocks and marine growth. Not cultural features were identified during the dive. While an attempt at a circular 10m search was made, strong current and low visibility meant only a small portion of the seafloor was able to be surveyed before the dive was aborted.

2.4.1.3 T1_3

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
5	693293.00	8624947.00	Debris scatter, or possible anti-submarine net remains FUGRO ID: NCL_SC_021	Width: 0.00 Height: 0.00 Length: 0.59 Shadow: 0.00	10	27 m

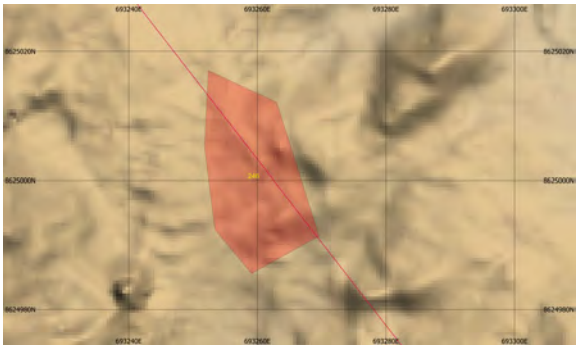


Figure 11: Target 246, MBES image.

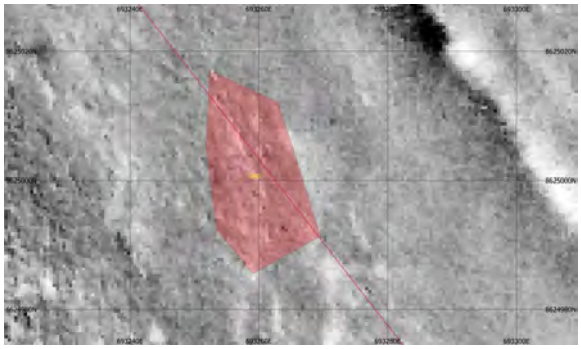


Figure 12: Target 246, SSS image.

Inspection details for T1_3		
Date: 06-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Circular search 10 m		
Swim start (min): 1247	Swim end (min): 1311	Total time (min): 24
Depth: 27 m	Water visibility: 0 m – 1 m	Seabed visibility: Poor

Target description: This dive was an attempt to locate Target 246 aka NCL_SC_021. In addition to locating 246, an attempt was made to locate the anti-sub net chain that disappeared into the seabed at the end of transect T1_1. The seabed in the search area was similar to Transect T1_1 with fine grain sandy sediment as well as scattered rocks and marine growth. Not cultural features were identified during the dive. While an attempt at a circular 10m search was made, strong current and low visibility meant only a small portion of the seafloor was able to be surveyed before the dive was aborted.

2.4.1.4 T1_4

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
8	693163.04	8625273.25	Anti-submarine net mooring blocks and chain NCL_SC_022 and Target ID: 244 (aka NCL_SC_023, 024, 025)	Width: 2.18 m Height: 0.00 m Length: 6.65 m Shadow: 0.00m	Variable, from 40 to 86	21 m

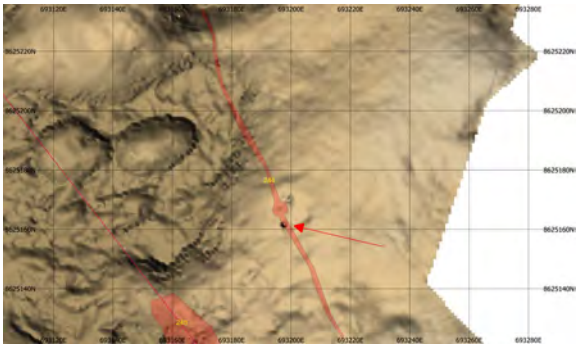


Figure 13: Target 244 (aka NCL_SC_023, 024, 025) MBES image.

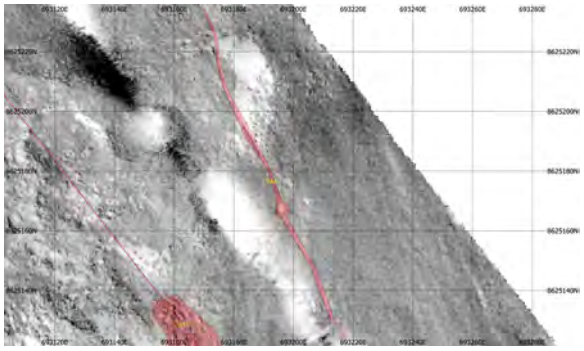


Figure 14: Target 244 (aka NCL_SC_023, 024, 025) SSS image.

Inspection details for T1_4		
Date: 06-06-2022	Method: ROV	Tide: Slack
Distance and direction: 150 m, 160° SSE		
Swim start (min): 1605	Swim end (min): 1644	Total time (min): 39
Depth: 21 m	Water visibility: 1 – 2 m	Seabed visibility: Poor

Target description: The ROV was dropped on a target that appeared on MBES data to be a concrete block mooring used for the anti-submarine netting, located at 693163.04 m E, 8625273.25 m N. The target chosen was not identified previously by FUGRO or CA but was identified immediately upon visual inspection by the ROV. This concrete block was determined to be the northern terminus of the "trot" of moorings (running to the southern terminus at Target 167) because no chain extended from the northern side of the block. After identification, the ROV followed the chain in a SSE course at 160° for approximately 55m until reaching target NCL_SC_022. This target was again identified as a concrete mooring block for the anti-sub netting. Following the chain at roughly the same heading, the ROV was piloted to the location of Target 244 (aka NCL_SC_023, 024, 025), approximately 60m SSE of NCL_SC_022. Between NCL_SC_022 and Target 244, the chain was seen to have several breaks along its length and appeared to have been dragged out of position by an anchor or trawl. A sharp kink in the line of chain was seen immediately north of target 244. The ROV continued following the chain SSE from Target 244 until tether ran out, approximately 50m further SSE.

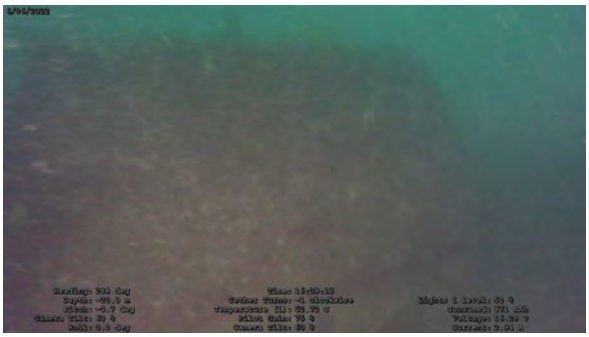


Figure 15: Mooring block at northern terminus of trot. (Video 2022-06-06_16.08.58; 00:15).

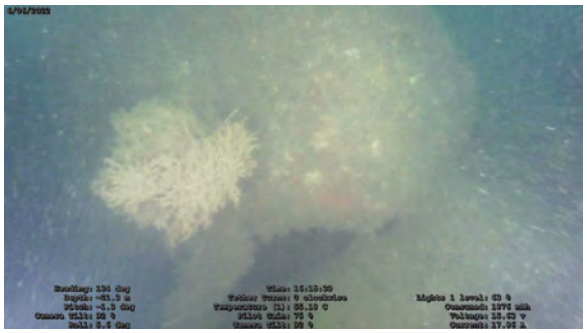


Figure 16: Mooring block NCL_SC_022 with chain extending from north face. (Video 2022-06-06_16.08.58; 06:40).

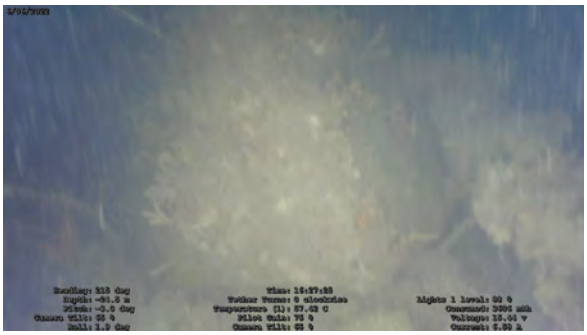


Figure 17: Mooring block Target 244 with chain extending from north face. (Video 2022-06-06_16.08.58; 18:24).

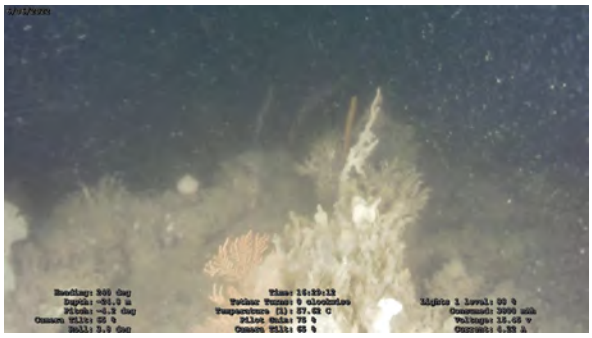


Figure 18: Kinked chain near Target 244. (Video 2022-06-06_16.08.58; 20:11).

2.4.1.5 T1_6

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
14	693212.30	8625132.30	Anti-submarine net mooring blocks and chain	Width: 0.00 Height: 0.00 Length: 0.00 Shadow: 0.00	Variable, from 46 to 0	28 m

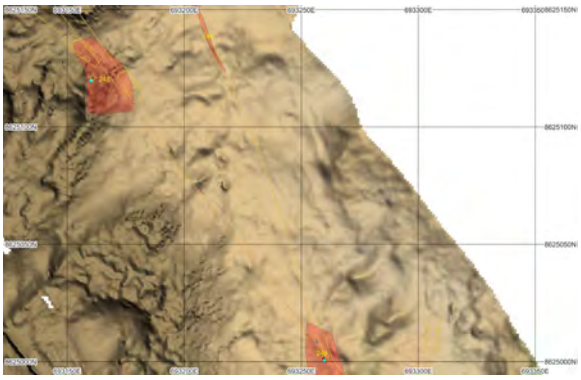


Figure 19: MBES image of general area of T1_6.

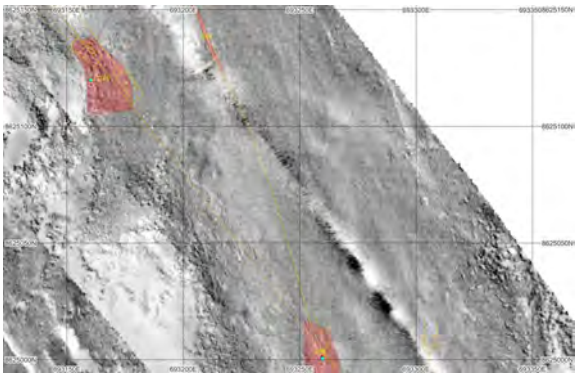


Figure 20: SSS image of general area of T1_6.

Inspection details for T1_6		
Date: 07-06-2022	Method: ROV	Tide: Slack
Distance and direction: 200 m, 160° SSE		
Swim start (min): 1045	Swim start (min): 1106	Total time (min): 21
Depth: 28 m	Water visibility: 2 – 3 m	Seabed visibility: Fair

Target description: Dive 14, transect T1_6, was started approximately 40 metres south-southeast of target 166 at a point close to or overlapping the termination of T1_4. A previous attempt at this transect, Dive 10 (T1_5), had been aborted due to heavy currents preventing the ROV from submerging. The anchor chain was quickly located upon descent and was followed in a similar SSE heading to T1_4, at approximately 160° for around 200 metres until the ROV's tether ran out (Figure 22). Throughout the length of T1_6, the chain was periodically buried under silty sediment, occasionally to the point where no marine growth could be seen above the seabed. At the end of the tether, the chain occurred to have several kinks, and a potential area of debris field or small rocks (Figure 23). Marine growth inhibited identification of the exact nature of these objects. No concrete blocks were seen along the length of the T1_6.

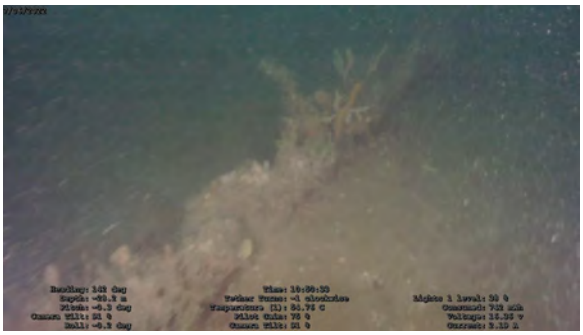


Figure 21: Length of chain southeast of target 166. (Video 2022-06-07_10.46.37; 03:54).

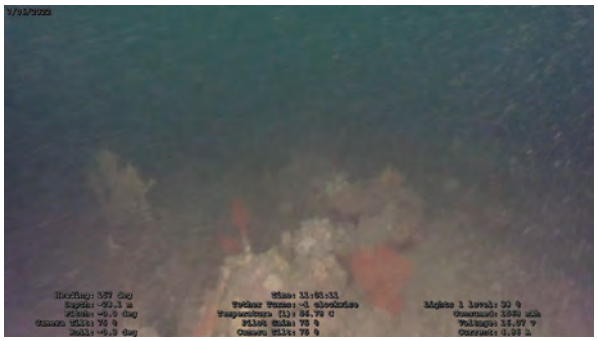


Figure 22: Kink in chain near end of T1_6. (Video 2022-06-07_10.46.37; 14:30).

2.4.1.6 T1_7

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
15	693255.71	8625021.11	Anti-submarine net mooring blocks and chain	Width: 0.00 Height: 0.00 Length: 0.00 Shadow: 0.00	Variable, from 26 to 0	29 m

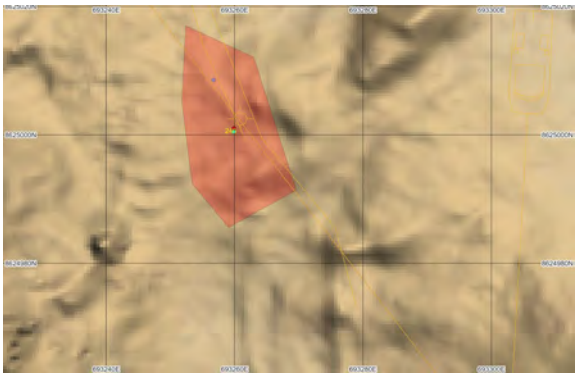


Figure 23: MBES image of general area of T1_7.

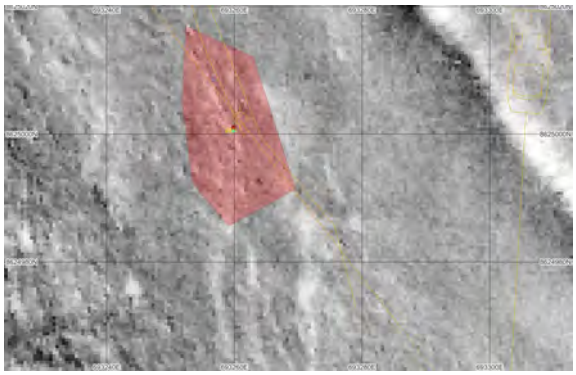


Figure 24: SSS image of general area of T1_7.

Inspection details for T1_7		
Date: 07-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: 200 m, 160° SSE		
Swim start (min): 1130	Swim end (min): 1200	Total time (min): 30 min
Depth: 29 m	Water visibility: 0 – 1 m	Seabed visibility: Poor

Target description: T1_7 was intended to "close the gap" between T1_6 and T1_1, approximately covering the area where Target 246 was thought to be. The ROV was dropped close to the position of 246 and was able to locate the chain identified in T1_6 (Figure 27). Following the chain SSE, the ROV recorded the chain ending at an indeterminate point in the seabed. At this location, a pile of branching metal debris was seen (Figure 28). The debris appeared to be either steel wire rope or cable, not chain, and extended several metres in multiple directions from a central point, near the end of the chain (Figure 29 & Figure 30). Heavy current and low visibility inhibited the ROV from obtaining a clear picture of the area, however, a cross shaped search pattern of 20m east-west-south from the branching cable indicated that a gap existed along the anti-submarine net trot chain, about 20m south of the proposed GEP route.

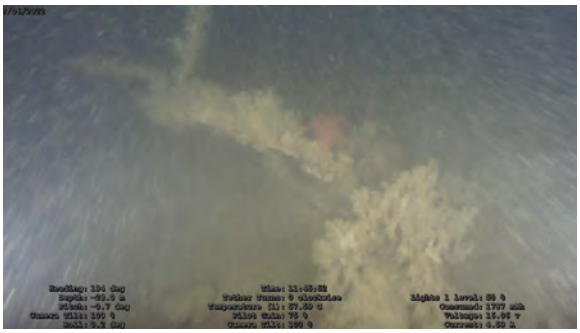


Figure 25: Screen grab of chain at a southern heading, with a large protuberance extending to the west. (Video 2022-06-07_11.30.28; 15:20).

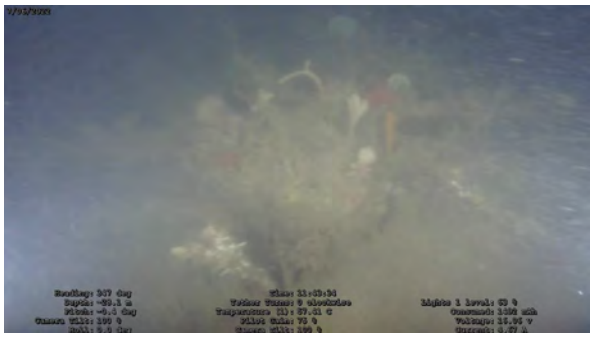


Figure 26: Screen grab of central location of branching "cable" or steel rope. (Video 2022-06-07_11.30.28; 13:01).

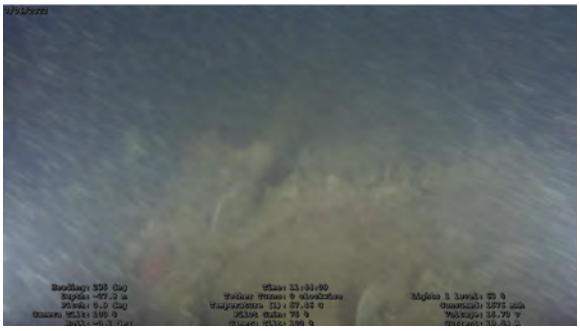


Figure 27: Screen grab of several arms of branching "cable". (Video 2022-06-07_11.30.28; 13:41).

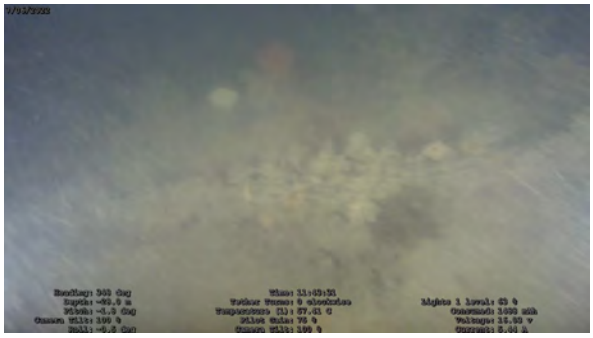


Figure 28: Detail of "cable". (Video 2022-06-07_11.30.28; 12:40).

2.4.2 *Heritage Transect 2*

T2_1 followed a line of concrete clump weights, connected by heavy chain, that were identified as the moorings for the WWII anti-submarine net. This transect was located between KP 107 and 108, adjacent to KP 107 and ran NNW from target 167, located at 693076.70 m E, 8625127.70 m N to target 164 (aka MA_002), located at 693039.84 m E, 8625225.61 m N. It was determined that the northernmost mooring device for the anti-submarine net trot was a large admiralty style anchor. A second dive (T2_2) was conducted on the anchor to take clearer images and aid in identification.

Chain was also seen extending south from Target 167 and targets likely to be mooring blocks were seen on MBES and SSS indicating that the trot extended further south to the Bayu-Undan GEP. It was decided that the proximity of these targets to the existing pipeline, and their distance from the proposed GEP, meant that further investigation in this direction was unnecessary.

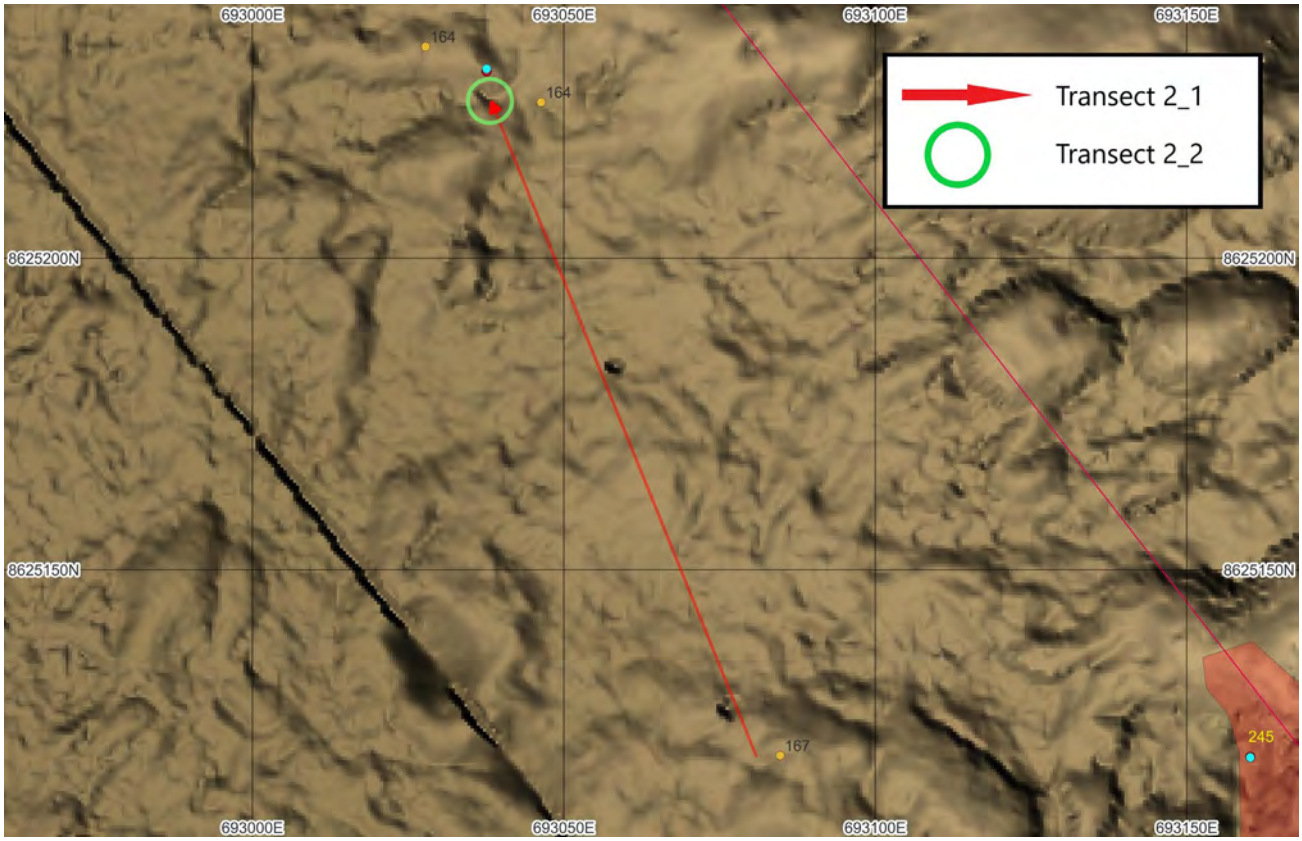


Figure 29: Dive locations for Heritage Transect 2.

2.4.2.1 T2_1

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
16	693077.90	8625120.30	Anti-submarine net mooring blocks and chain.	Width: 0.00 Height: 0.00 Length: 0.00 Shadow: 0.00	Variable, from 33 to 87	20 m

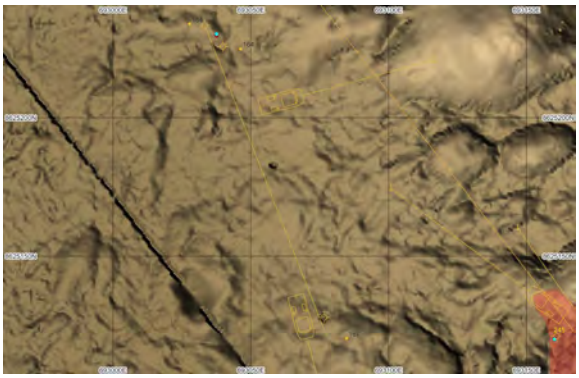


Figure 30: MBES image of general area of T2_1.

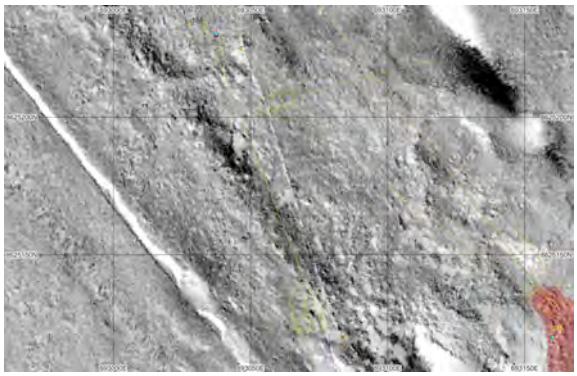


Figure 31: SSS image of general area of T2_1.

Inspection details for T2_1		
Date: 07-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: 123 m at 345° NNE		
Swim start (min): 1231	Swim end (min): 1255	Total time (min): 24
Depth: 20 m	Water visibility: 0.5 - 1 m	Seabed visibility: Poor - Fair

Target description: ROV was dropped almost exactly Target 167, identified as an anti-submarine net mooring block (Figure 34). The ROV confirmed that chain was extant in a southerly direction from Target 167, away from the proposed GEP route. The ROV was then turned at a NNE heading and continued along the line of the chain to the second mooring block located at 693058.40 m E and 8625182.00 m N (Figure 35). The ROV again continued along the chain until reaching Target 164 (aka NCL_SC_026, MA_002). Upon reaching Target 164, it was immediately clear that this target was an anchor adapted for use as a mooring device for the anti-submarine net chain. Due to poor visibility and worsening currents, it was decided to finish the dive at this point and return to investigate Target 164 when a slack tide would provide more favourable conditions.

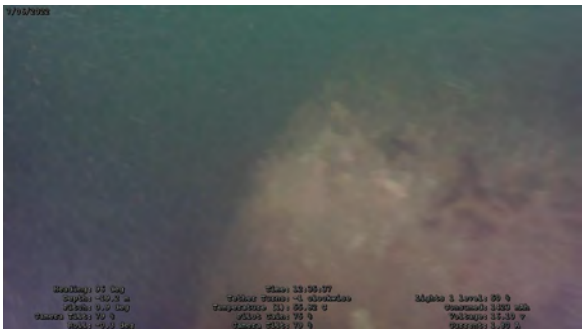


Figure 32: Screen grab Target 167, mooring block. (Video 2022-06-07_12.31.43; 03:35).

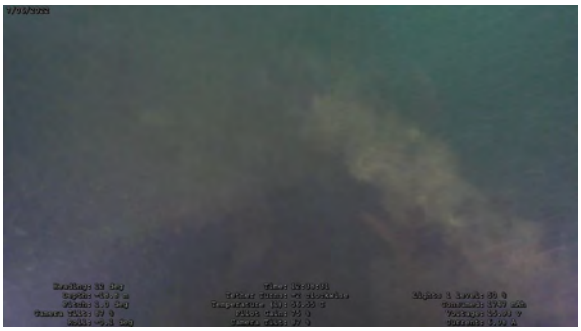


Figure 33: Screen grab of second anti-submarine net mooring block and chain, southern side of block. (Video 2022-06-07_12.31.43; 06:46).

2.4.2.2 T2_2

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
21	693036.33	8625230.54	Large ship's anchor, adapted for use as anti-submarine net mooring device.	Width: 4.00 Height: 1.90 Length: 7.00	33	18 m

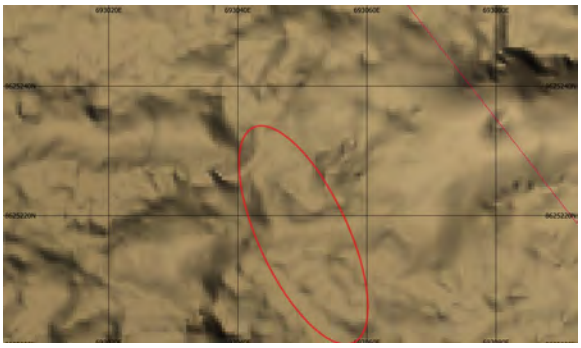


Figure 34: MBES image of Target 164 and chain extending south.

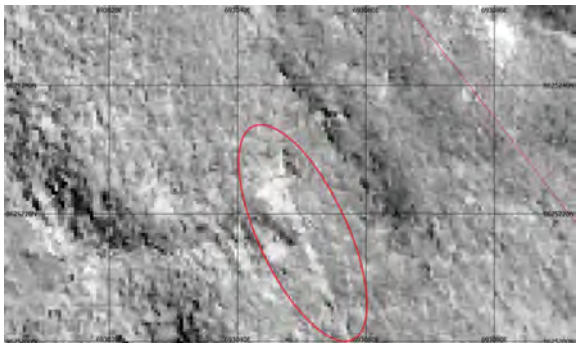


Figure 35: SSS image of Target 164 and chain extending south.

Inspection details for T2_2		
Date: 07-06-2022	Method: ROV	Tide: Slack
Distance and direction: Investigation of specific feature		
Swim start (min): 1646	Swim end (min): 1702	Total time (min): 16
Depth: 18 m	Water visibility: 3 m - 4 m	Seabed visibility: Good

Target description: T2_2 was undertaken specifically to record higher quality images of Target 164 and to determine if any portion of the anti-submarine trot extended north towards the proposed GEP route. Upon relocating the chain, the ROV was manoeuvred north to Target 164, a large anchor, seemingly admiralty pattern in style. The ROV made a full three-dimensional survey of the anchor and determined that the anti-submarine net chain was attached by a large D-shackle to the head of the anchor (Figure 41). The anchor had a large rectangular stock with possible evidence of iron bands, suggesting that the stock may be made of wood (Figure 43). The ROV took measurements of the length of the arm protruding from the seabed by measuring the depth at the tip of the fluke to the crown, determining the arm to be approximately 1.9m in length (Figure 38, Figure 39, and Figure 42). The relatively narrow, round shank extended north from the stock, ending at a fluke and arm protruded at a 90-degree angle from the seabed (Figure 40). No further mooring devices, chain or cable was identified to the north of Target 164, indicating that the anchor was the northern terminus of this trot.

Figure 36: Arm and fluke of anchor, looking west. (Video 2022-06-07_16.47.23; 04:08).

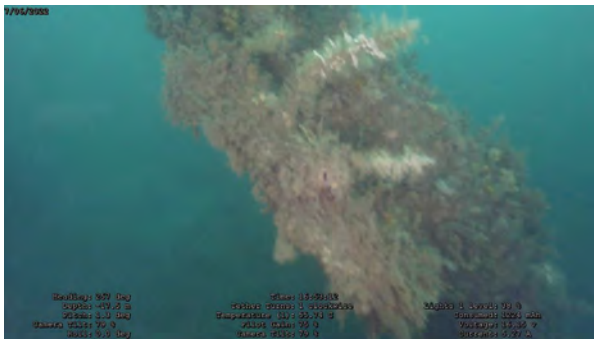


Figure 37: Detail of fluke, looking west. (Video 2022-06-07_16.47.23; 05:46).

Figure 38: Anchor shank, looking east. (Video 2022-06-07_16.47.23; 11:22).

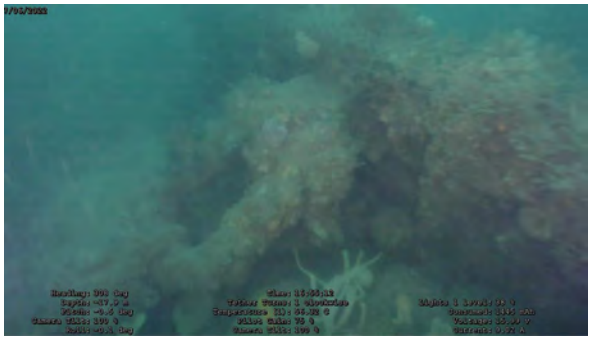


Figure 39: Anchor ring, head, and stock, looking northwest. Note chain extending from D-shackle attached to head, and possible iron band on stock on right side of photo. (Video 2022-06-07_16.47.23; 05:51).

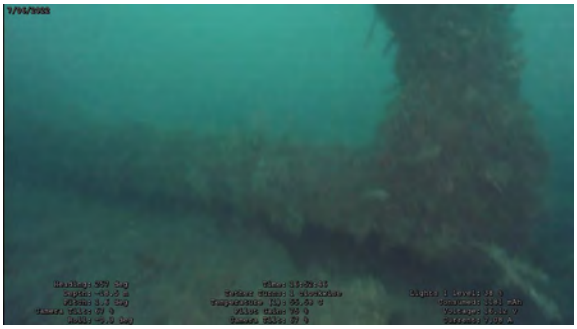


Figure 40: Anchor throat, crown, and arm, looking southwest. (Video 2022-06-07_16.47.23; 05:19).

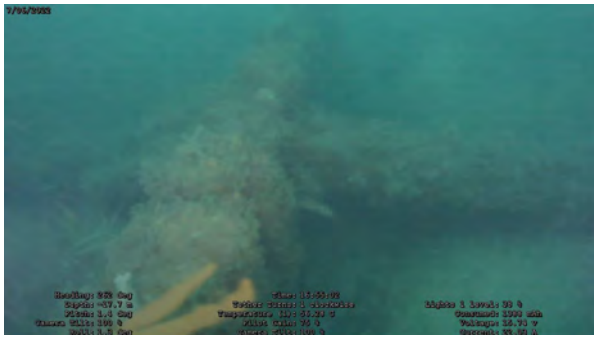


Figure 41: Transverse view of stock, shank, and head, looking west. Note possible iron band around stock in foreground. (Video 2022-06-07_16.47.23; 07:37).

2.4.3 *Heritage Transect 3*

T3_1 followed a line of concrete clump weights, connected by heavy chain, that were identified as the moorings for the WWII anti-submarine net. This transect was located approximately halfway between KP 107 and 108 and ran NNW from a location several metres south of target NCL_SC_017, at 693417.30 m E, 8624861.20 m N to target 166 (aka NCL_SC_018), and beyond before finishing at a location near 693375.80 m E, 8624949.10 m N. The chain was clearly seen extending north from this location, however, it was determined that because this was in the opposite direction from the proposed GEP route, no further investigation was required.

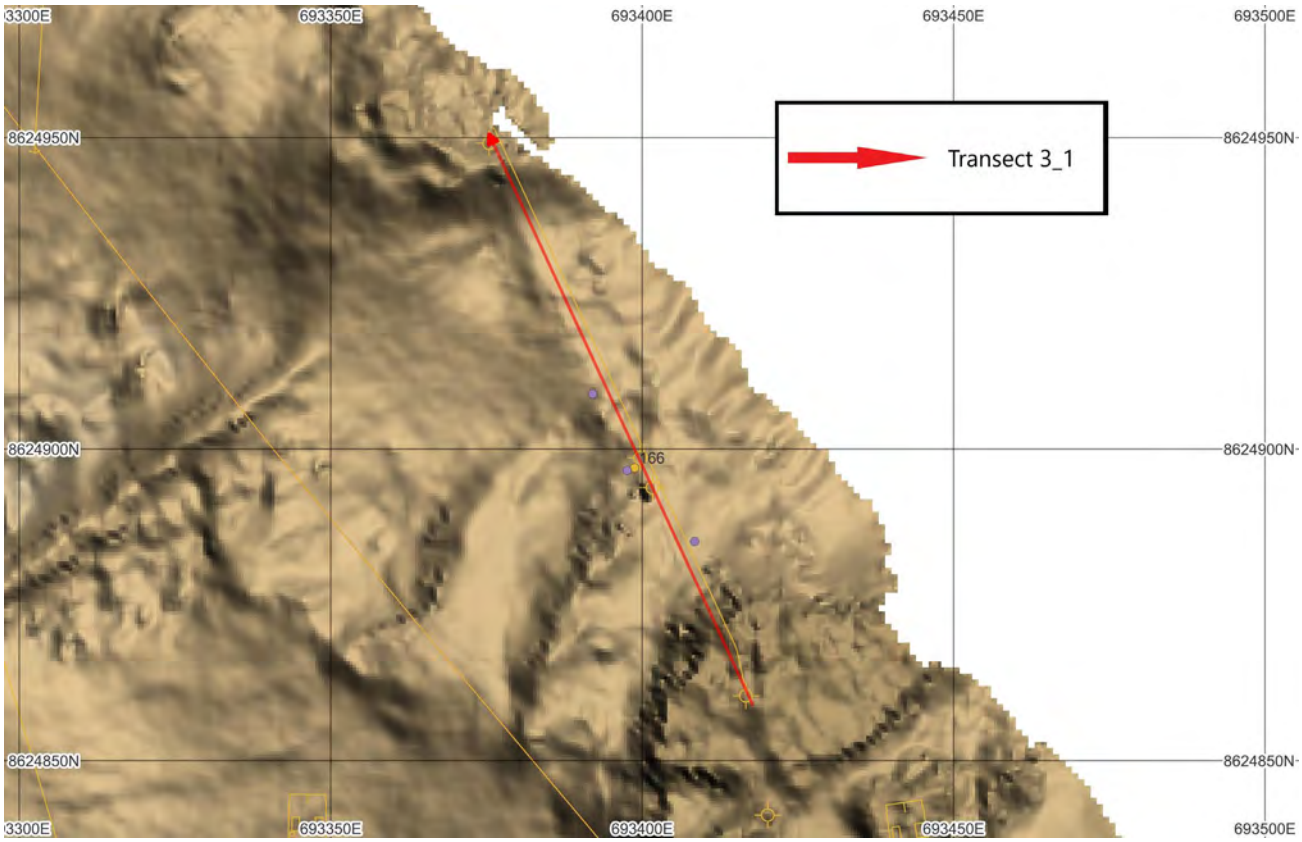


Figure 42 : Dive location for Heritage Transect 3.

2.4.3.1 T3_1

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
20	693416.67	8624860.36	Anti-submarine net mooring blocks and chain.	Width: 0.00 Height: 0.00 Length: 0.00 Shadow: 0.00	Variable, from 21 to 62	20 m

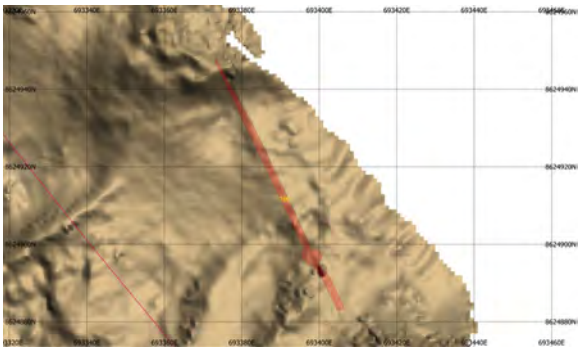


Figure 43: MBES image of general area of T3_1 and target 166.

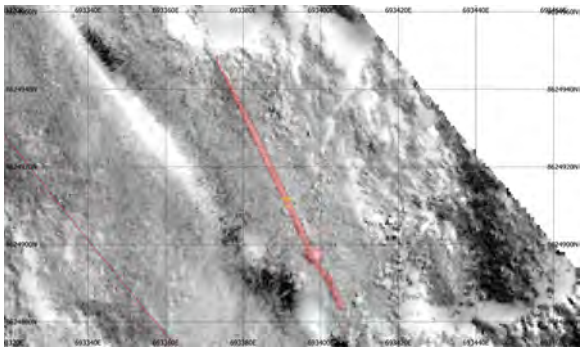


Figure 44: SSS image of general area of T3_1 and target 166.

Inspection details for T3_1		
Date: 07-06-2022	Method: ROV	Tide: Slack
Distance and direction: 150 m at 336° NNE		
Swim start (min): 1558	Swim end (min): 1626	Total time (min): 28
Depth: 20 m	Water visibility: 2 m – 3 m	Seabed visibility: Fair

Target description: The ROV was dropped on an area of seabed that was very rocky, with large rock shelfs and individual pebbles scattered around. This seabed topography made locating the chain and mooring blocks difficult, as potential cultural objects may have been obscured by the rocky seafloor and marine growth. Once the chain was located, the ROV took a southern heading and followed the chain towards the proposed GEP location at a heading of 120° ESE (Figure 47). Approximately 20 m further the chain was kinked at almost a 90-degree angle, with a clear break (Figure 48). Further investigation south found no further sign of the chain or mooring blocks, indicating that the chain had likely been broken and possibly removed or buried in this area. Turning north, the ROV followed the chain at a heading of 325° NW, finding this length of chain broken around the rocks and rock shelfs. Four more sections of broken chain were identified, all oriented on approximately the same heading, before the mooring block at Target 166 was located (Figure 49). The chain continued unbroken NNW from Target 166 for approximately 60 m before a second mooring block was identified (Figure 50). This second block appeared to be flipped upside down and had possible debris trapped under it (Figure 51). The chain continued the same heading from the north side of the second block, but as this was in the opposite direction of the proposed GEP route, it was decided to end investigation.

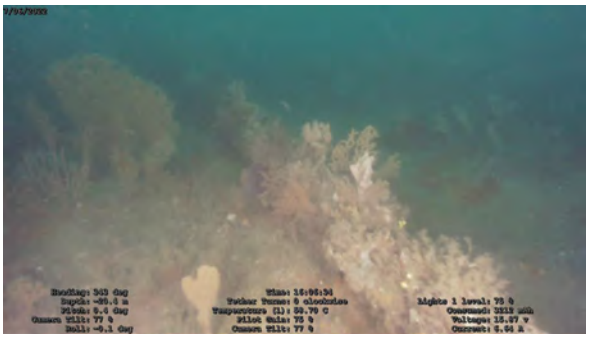


Figure 45: Chain located near ROV drop site. (Video 2022-06-07_15.56.55; 09:37).

Figure 46: Chain kinked south of drop site. Direction of chain shown by red line. (Video 2022-06-07_15.56.55; 09:56).

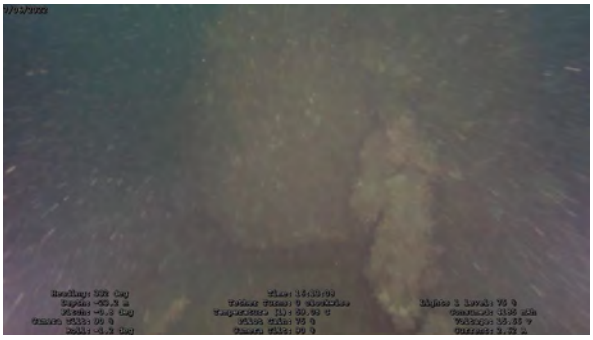


Figure 47: Target 166, mooring block, facing north. (Video 2022-06-07_15.56.55; 16:10).

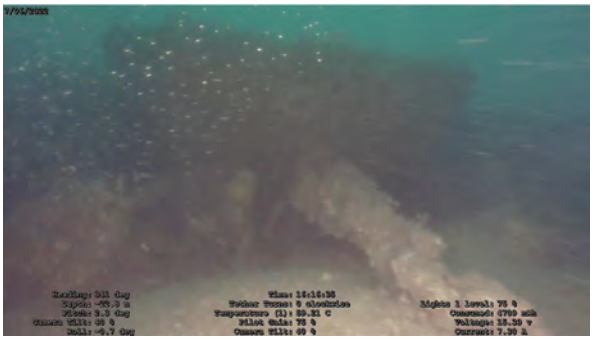


Figure 48: Second mooring block, apparently flipped upside down. (Video 2022-06-07_15.56.55; 19:37).

Figure 49: Apparent debris wedged under second mooring block. (Video 2022-06-07_15.56.55; 21:23).

2.4.4 *Individual Heritage Targets*

In addition to the three heritage transects undertaken on the anti-submarine net mooring trots, an additional 10 isolated targets located within 50m of the proposed GEP route were investigated.

2.4.4.1 Target 142

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
7	690559.00	8628514.00	Large boulders FUGRO ID: NCL_SC_042	Width: 12.00 Height: 0.00 Length: 15.00 Shadow: 0.00	0	32 m

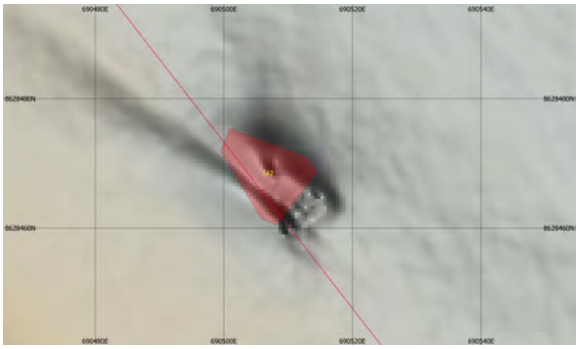


Figure 50: MBES image of Target 142.

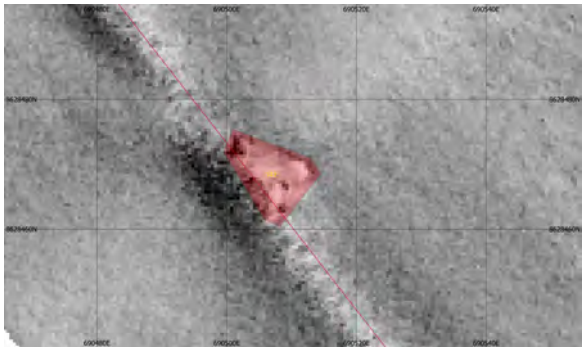


Figure 51: SSS image of Target 142.

Inspection details for Target 142		
Date: 06-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Circular search 10 m		
Swim start (min): 1458	Swim end (min): 1535	Total time (min): 37
Depth: 32 m	Water visibility: 0 m – 2 m	Seabed visibility: Poor

Target description: The investigation for Target 142 was combined with ecology survey 26_BACI-5P. Target was located and determined to be numerous large boulders, non-cultural. Boulders ranged from 2 – 5 metres in size (Figure 54, Figure 55).

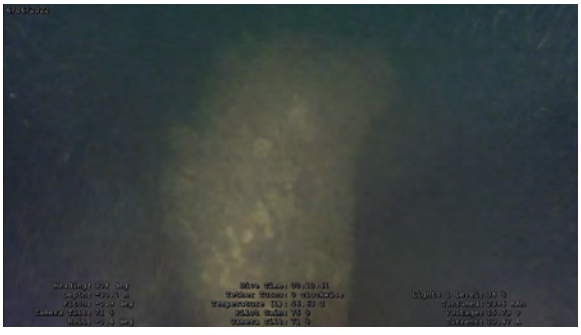


Figure 52: Boulder located at Target 142. (Video 2022-06-06_15.00.03; 05:01).

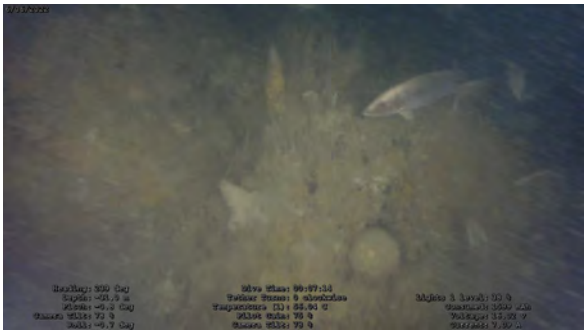


Figure 53: Detail of large boulder at Target 142. (Video 2022-06-06_15.00.03; 04:30).

2.4.4.2 Target 245

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
9	693164.00	8625128.00	Field of pebbles and rocks. Possibly MA_012	Width: 22.00 Height: 0.00 Length: 31.00 Shadow: 0.00	0	21 m

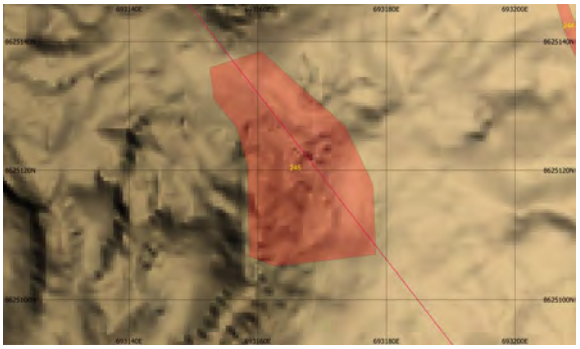


Figure 54: MBES image of Target 245, area of debris field highlighted.

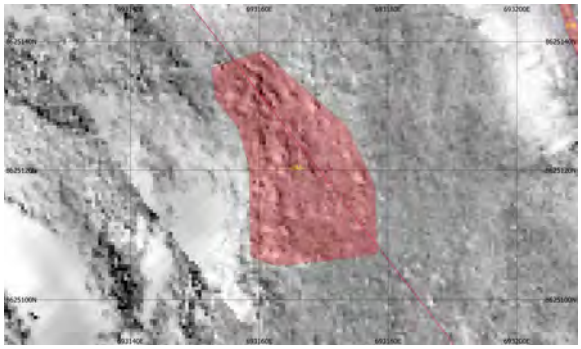


Figure 55: SSS image of Target 245, area of debris field highlighted.

Inspection details for Target 245		
Date: 06-06-2022	Method: ROV	Tide: Flowing
Distance and direction: Circular search 10 m		
Swim start (min): 1701	Swim end (min): 1710	Total time (min): 9
Depth: 21 m	Water visibility: 0 m – 2 m	Seabed visibility: Poor

Target description: Target 245 was located and determined to be a mound or field of rocks and pebbles, ranging in size from several centimetres to 2 metres across (Figure 58, Figure 59).

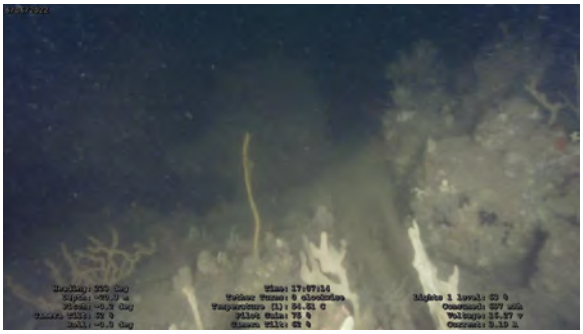


Figure 56: Larger rocks located at Target 245. (Video 2022-06-06_17.02.18; 03:20).

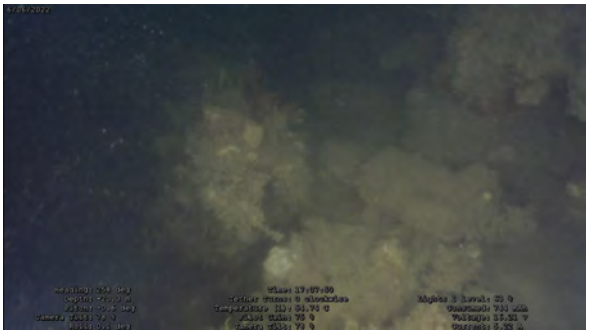


Figure 57: Smaller rocks located at Target 245. (Video 2022-06-06_17.02.18; 05:29).

2.4.4.3 Target 241

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
19	691791.84	8626921.00	Seabed depression FUGRO ID: NCL_SC_032	Width: 8.00 Height: 0.00 Length: 9.00 Shadow: 0.00	42	24 m

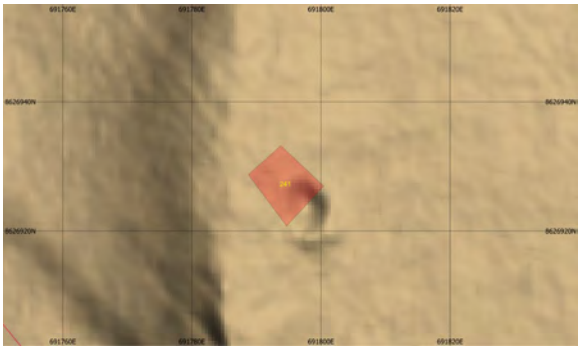


Figure 58: MBES image of Target 241.

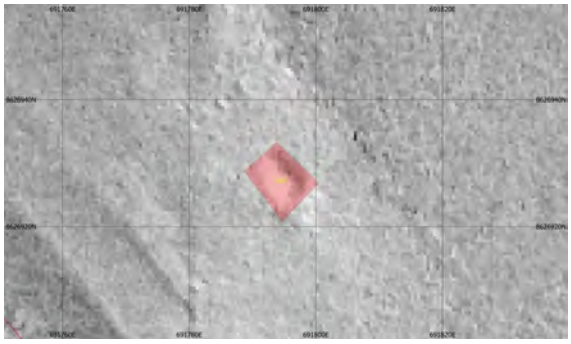


Figure 59: SSS image of Target 241.

Inspection details for Target 241		
Date: 07-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Circular search 10m		
Swim start (min): 1453	Swim end (min): 1529	Total time (min): 36
Depth: 24 m	Water visibility: 2 – 3 m	Seabed visibility: Fair

Target description: Target 241 was determined to be a shallow depression in the seabed, approximately 1.5m deep with gently sloping sides. Dive for 241 was combined with investigation of NCL_SC_031 and ecology survey 24_BACI-4P.

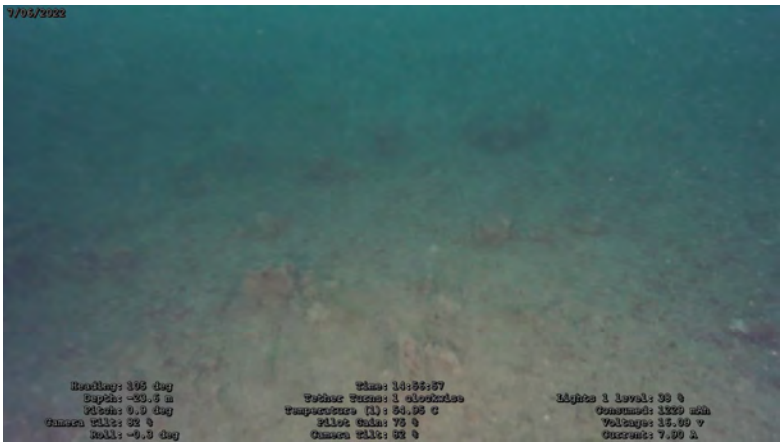


Figure 60: Detail of seabed in depression located at Target 241. (Video 2022-06-07_14.54.13; 02:42).

2.4.4.4 Target NCL_SC_031

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
19	691791.84	8626921.00	Possible debris.	Width: 0.70 Height: 0.00 Length: 1.40 Shadow: 0.00	25	24 m

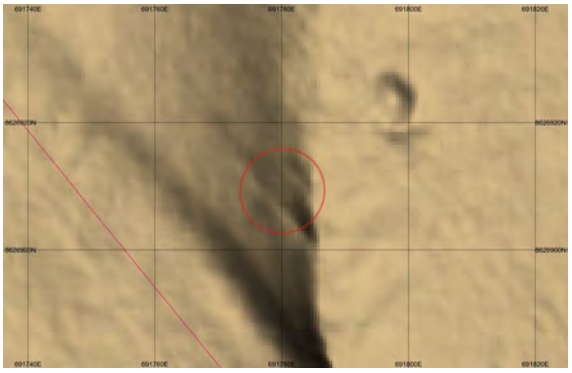


Figure 61: MBES image of Target NCL_SC_031.

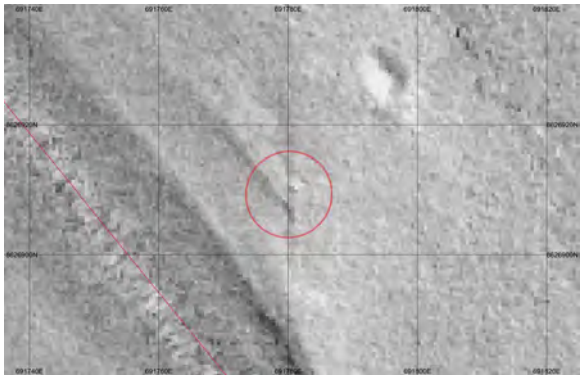


Figure 62: SSS image of Target NCL_SC_031.

Inspection details for Target NCL_SC_031		
Date: 07-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Circular search 10m		
Swim start (min): 1453	Swim end (min): 1529	Total time (min): 36
Depth: 24 m	Water visibility: 2 – 3 m	Seabed visibility: Fair

Target description: The ROV continued directly from Target 241 to the location of NCL_SC_031 at a bearing of 232° SW. No cultural material was identified at this location. Seabed consisted of fine sand with numerous sand ripples.

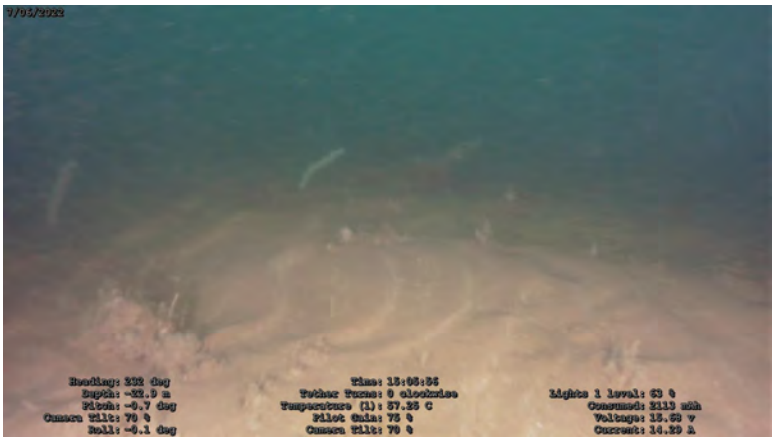


Figure 63: Seabed and sand ripples at NCL_SC_031. (Video 2022-06-07_15.04.06; 01:48).

2.4.4.5 Target 175

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
22, 23	694295.02	8623601.00	Linear ridge. Possibly associated with MA_009	Width: 5.00 Height: 0.00 Length: 24.00 Shadow: 0.00	1.5	28 m

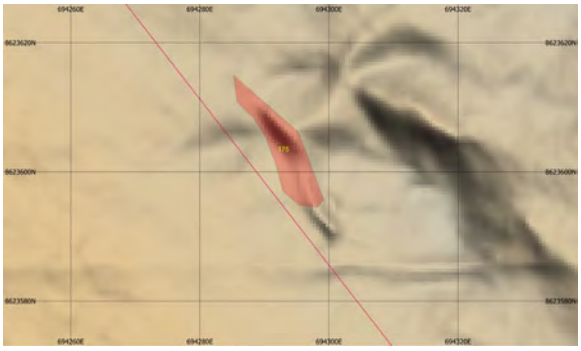


Figure 64: MBES image of Target 175.

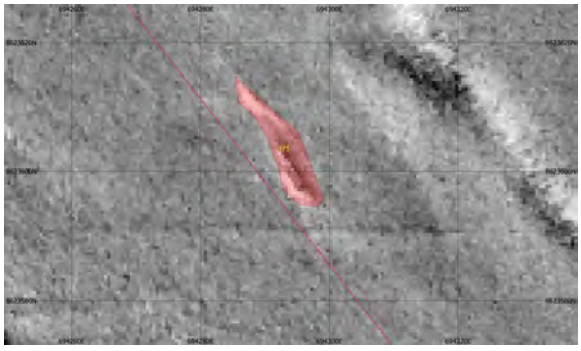


Figure 65: SSS image of Target 175.

Inspection details for Target 175		
Date: 08-06-2022	Method: ROV	Tide: Flowing
Distance and direction: 25 m at 147° SE		
Swim start (min): 0748	Swim end (min): 0810	Total time (min): 22
Depth: 28 m	Water visibility: 3 m – 4 m	Seabed visibility: Good

Target description: Two dives were attempted on Target 175. The first, dive 22, was unsuccessful in finding the target, and was aborted. The second, dive 23, was successful in locating the target.

Target 175 appeared to be a low ridge of rock and coral, rising approximately 1 – 2 m from the surrounding seabed, which was mostly sand. The ridge measured approximately 25 m in total length and 2-3 m in width and was separated in two sections by a small gap about halfway along the ridge. No obvious cultural material was seen during the dive.

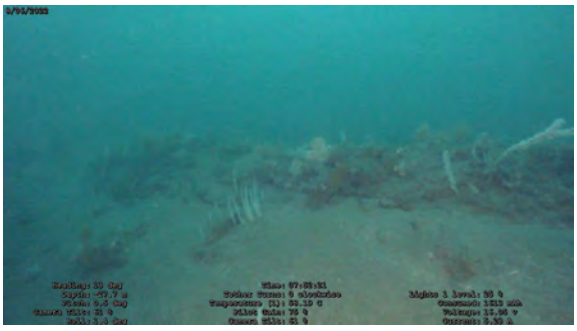


Figure 66: North section of ridge, facing northeast. (Video 2022-06-08_07.51.14; 01:05).

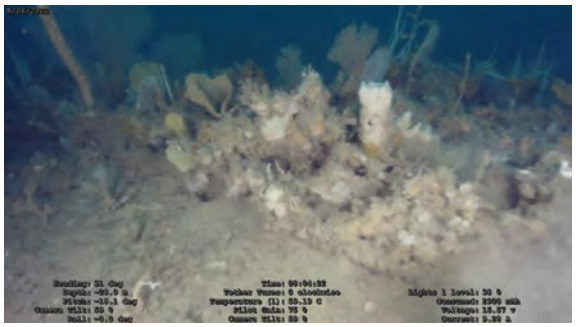


Figure 67: Detail of southern section of ridge. (Video 2022-06-08_07.51.14; 13:04).

2.4.4.6 Target 174

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
24	694194.61	8623695.89	Single discrete object in close location to series of mag strikes across KP 109 FUGRO ID: NCL_SC_013, MA_010	Width: 2.00 Height: 1.00 Length: 3.00 Shadow: 0.00	15	28 m

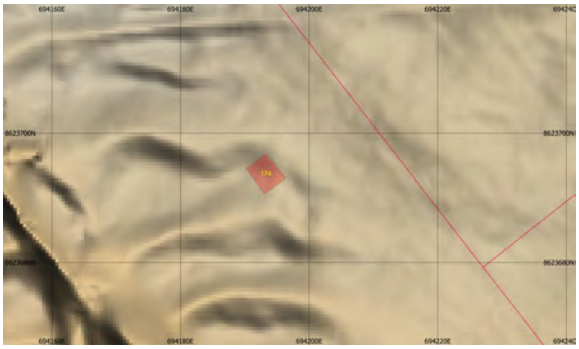


Figure 68: MBES image of Target 174.

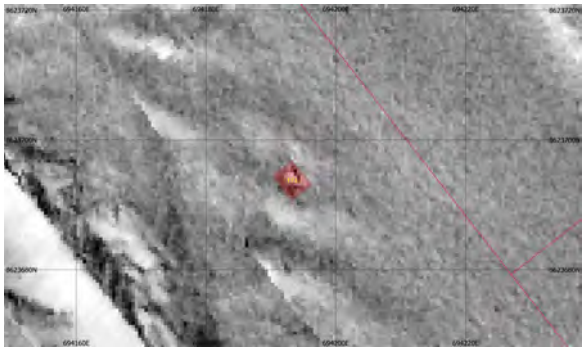


Figure 69: SSS image of Target 174.

Inspection details for Target 174		
Date: 08-06-2022	Method: ROV	Tide: Flowing
Distance and direction: Cross search pattern, 10m NESW		
Swim start (min): 0826	Swim end (min): 0841	Total time (min): 15
Depth: 28 m	Water visibility: 3 m – 4 m	Seabed visibility: Good

Target description: In an improvement on target locating, a clump weight with a line attached to the buoy was dropped on the location of the target while the vessel was moving. Once the vessel was anchored, the ROV used the buoy line as a target reference and descended on the line to the seabed. Once on the bottom, the ROV began a cross shaped search pattern with 10 m transects out from the clump weight in all four cardinal directions.

Target 174 was located a short distance west of the drop weight and appeared as two round mounds protruding from a sandy seabed, similar to a dumbbell in form. A full 360° visual survey of the object was completed. The whole structure was estimated to measure 2-3 m from end to end, 1 m wide, and 1 m above the seabed. The remains of cable or rope appeared to be wrapped around the middle arm connecting the two ends, with a coil wedged underneath the western end. The shape and presence of cable or rope suggests that Target 174 may be a windlass or winch. No other cultural objects were identified in the surrounding area.

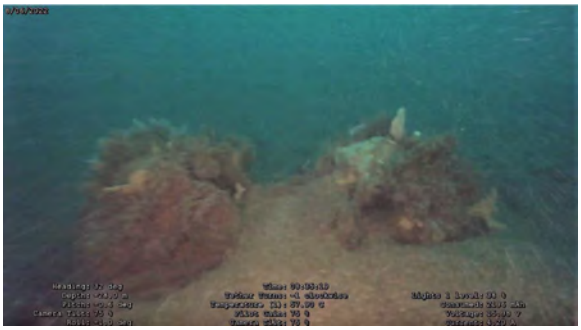


Figure 70: Target 174, facing north. (Video 2022-06-08_08.26.18; 08:58).

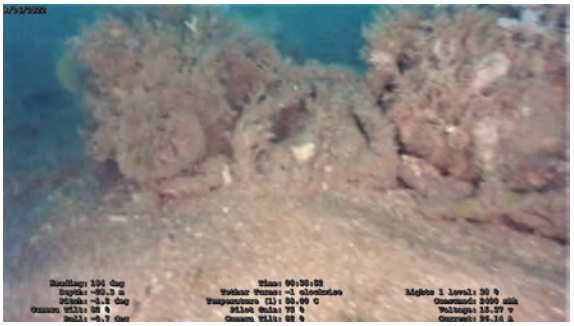


Figure 71: Target 174 facing south. Note possible cable or rope remains wrapped around middle. (Video 2022-06-08_08.26.18; 09:31).

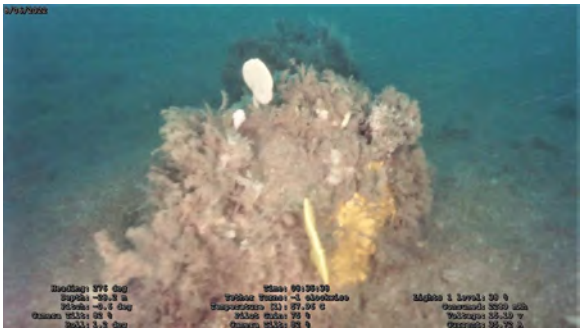


Figure 72: Target 174, facing west. (Video 2022-06-08_08.26.18; 09:17).

Figure 73: Target 174, facing east. Notice cable coiled underneath. (Video 2022-06-08_08.26.18; 09:35).

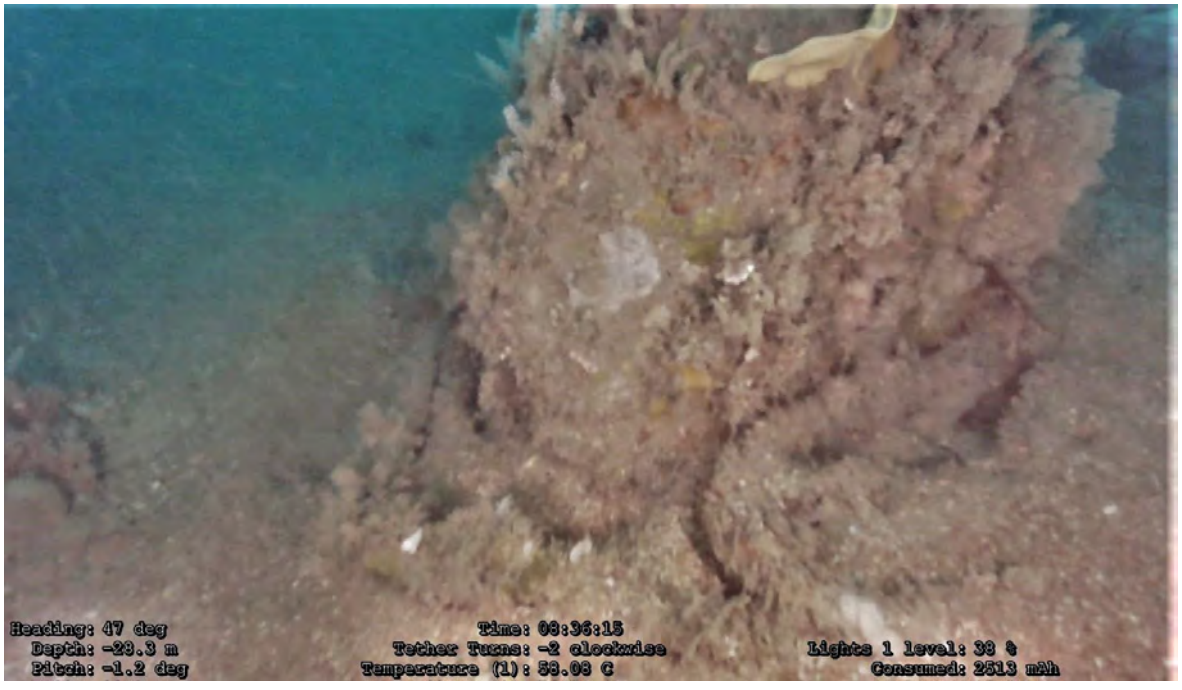


Figure 74: Detail of coil, facing east. (Video 2022-06-08_08.26.18; 09:55).

2.4.4.7 Target NCL_SC_016

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
25, 26	694168.64	8623820.49	Possible cable support or isolated non-ferrous object	Width: 1.60 Height: 0.00 Length: 3.50 Shadow: 0.00	39	30 m

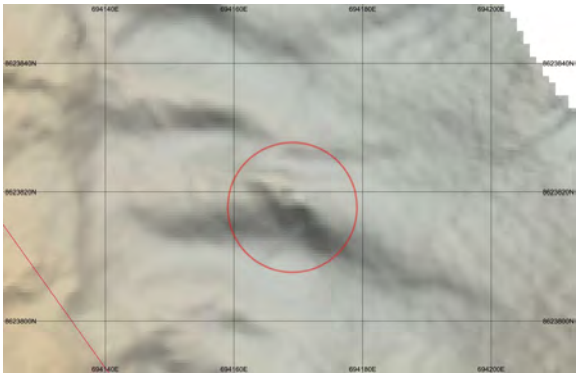


Figure 75: MBES image of Target NCL_SC_016.

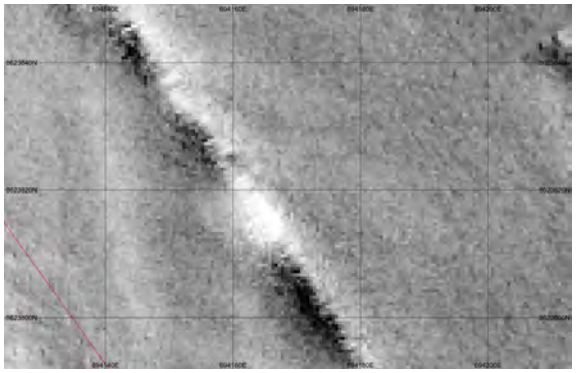


Figure 76: SSS image of Target NCL_SC_016.

Inspection details for Target NCL_SC_016		
Date: 08-06-2022	Method: ROV	Tide: Flowing
Distance and direction: Cross search pattern, 10m NESW		
Swim start (min): 0907	Swim end (min): 0933	Total time (min): 26
Depth: 30 m	Water visibility: 2 m – 3 m	Seabed visibility: Good

Target description: Two dives were attempted on Target NCL_SC_016. The first was aborted because the ROV lost sight of the guide rope. The second dive, 26, was successful in locating the target using the same methodology adopted for dive 24.

Target NCL_SC_016 was located several metres north of the drop weight and appeared to be a length of cable running in a generally east-west orientation (Figure 79). The cable was approximately 70mm in diameter and extended for about 35m in total length. Portions of the cable were buried in the sandy seabed, with both ends disappearing into the sand. Around 20 m west of the drop weight, the cable veered slightly north before turning sharply southwest and a 90-degree dogleg (Figure 80). The portion of the cable at the dogleg was clearly visible above the seabed and appeared to be ferrous (Figure 81). The location of the cable is roughly in the location of the 1879 telegraph cable and may be the disarticulated section of a 19th century telegraph cable.

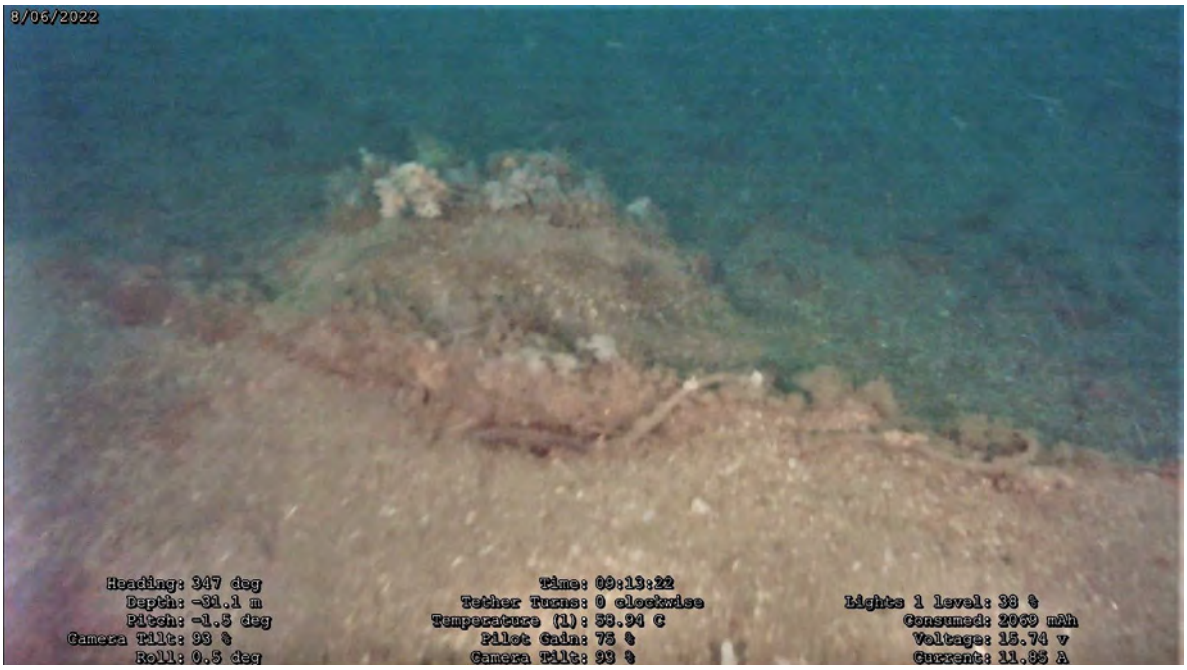


Figure 77: Target NCL_SC_016 just north of drop line. Cable running at heading of 274° W. (Video 2022-06-08_09.06.58; 06:10).

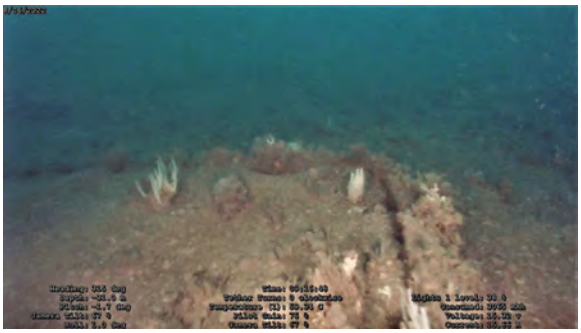


Figure 78: Dogleg in cable. (Video 2022-06-08_09.06.58; 09:47).

Figure 79: Detail of cable at dogleg. Note possible ferrous nature of cable. (Video 2022-06-08_09.06.58; 10:56).

2.4.4.8 Target MA_007

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
29	695763.20	8621695.50	Inferred buried debris	21.5 nT	6	24 m

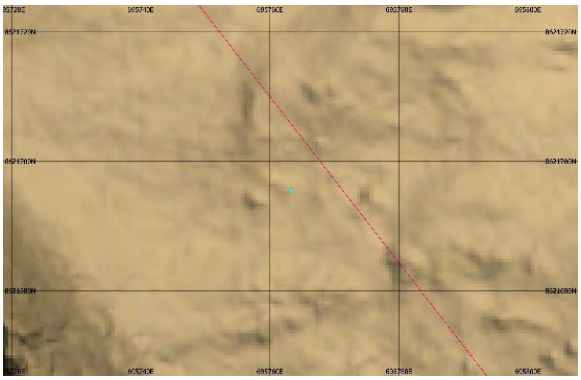


Figure 80: MBES image of the general area of Target MA_007.

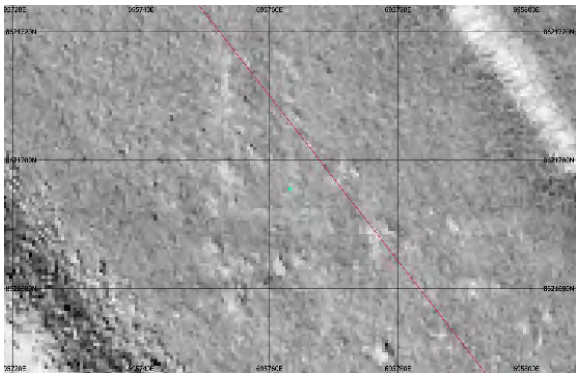


Figure 81: SSS image of the general area of Target MA_007.

Inspection details for Target MA_007		
Date: 08-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Cross search pattern, 10m NESW		
Swim start (min): 1256	Swim end (min): 1312	Total time (min): 16
Depth: 24 m	Water visibility: 2 m – 3 m	Seabed visibility: Good

Target description: Dive methodology was repeated from previous dives. A clump weight with buoy was dropped on the target from the moving vessel. Once anchored, the ROV was placed in the water and followed the line down to the seabed. Once on bottom, a cross shaped search pattern was conducted, with 10m transects in each cardinal direction from the clump weight.

The clump weight was dropped almost directly on top of Target MA_007, which was located 2m west. The target appeared to be a rectangular structure made of steel I-beams with very low relief above the sandy seabed. The structure consisted of at least 10 beams and possibly more as it was partially buried in the seabed. Three long beams delimited the structure on three sides, with the fourth side buried. Between these several smaller beams extended from one side of the structure, parallel with the other two sides. The main structure is estimated to be roughly five metres long and 2 metres wide. In addition to this contiguous material, there were several isolated and disarticulated beams scattered nearby. MA_007 may represent the remains of a steel barge, or possible discard.

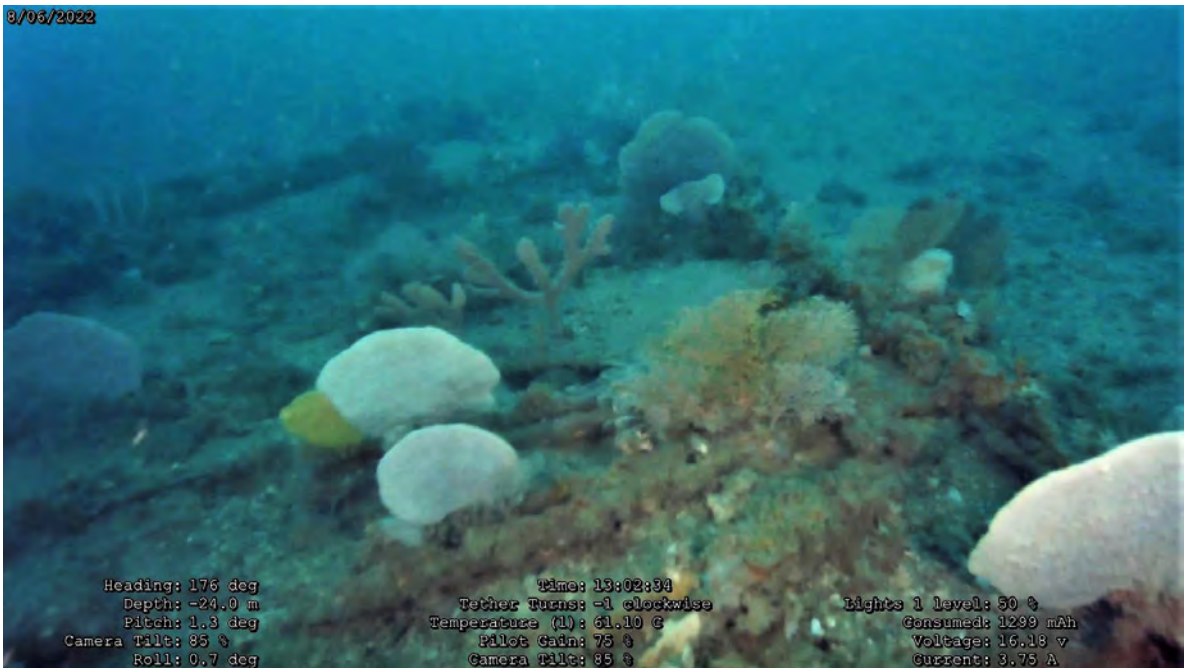


Figure 82: Overview of structure located at Target MA_007, facing south. Note rectangular shape of outer beams, with interior beams. (Video 2022-06-08_12.56.09; 06:23).

Figure 83: Overview of structure, facing west. (Video 2022-06-08_12.56.09; 04:10).

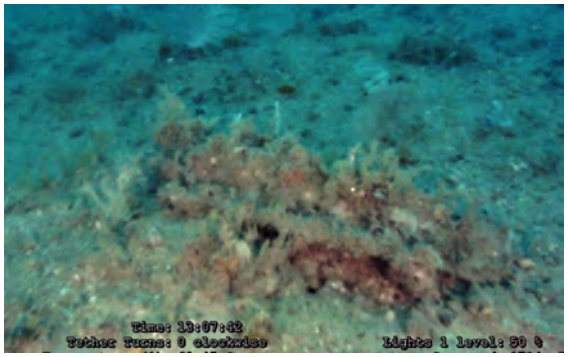


Figure 84: Isolated debris likely associated with the contiguous structure at MA_007. Debris located approximately 5m from structure. (Video 2022-06-08_12.56.09; 11:31).

2.4.4.9 Target MA_001

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
30	697628.20	8617803.70	Inferred buried debris	13.3 nT	35	20 m

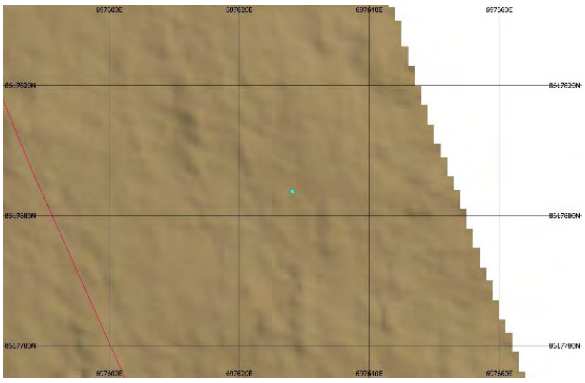


Figure 85: MBES image of the general area of Target MA_001.

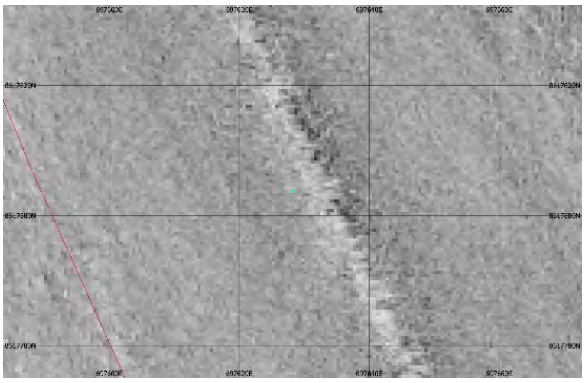


Figure 86: SSS image of the general area of Target MA_001.

Inspection details for Target MA_001		
Date: 08-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Cross search pattern, 10m NESW		
Swim start (min): 1338	Swim end (min): 1358	Total time (min): 20
Depth: 20 m	Water visibility: 2 m – 3 m	Seabed visibility: Good

Target description: Dive methodology was repeated from previous dives. A clump weight with buoy was dropped on the target from the moving vessel. Once anchored, the ROV was placed in the water and followed the line down to the seabed. Once on bottom, a cross shaped search pattern was conducted, with 10m transects in each cardinal direction from the clump weight.

The cross search found three instances of debris in the search area. A metal wheel rim was located 5m south of the clump weight, mostly buried in soft sediment (Figure 89). Next to the wheel was a length of steel rope, with one end tied in a loop (Figure 90 and Figure 91). These two objects are likely related and may represent a mooring for a buoy or other device.

A third piece of debris was located about 5m north of the clump weight. This object consisted of a cement block or possible metal scrap with two wires protruding (Figure 92). No other debris or cultural objects were seen in the area.

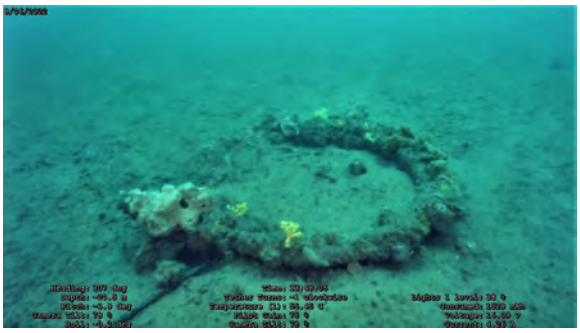


Figure 87: Metal wheel rim located at MA_001. Note wire protruding from side. (Video 2022-06-08_13.43.09; 04:54).

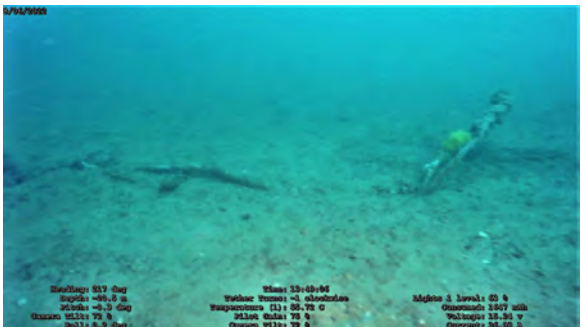


Figure 88: Steel rope or cable located next to the wheel rim. (Video 2022-06-08_13.43.09; 05:56).

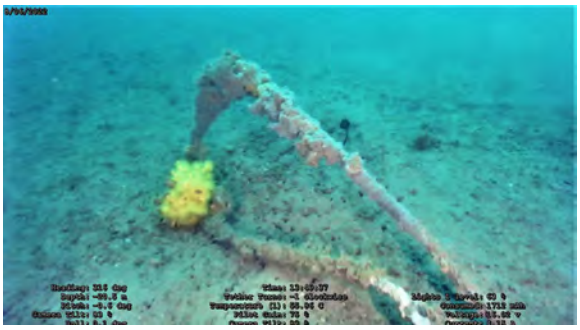


Figure 89: Detail of loop in cable. (Video 2022-06-08_13.43.09; 06:27).

Figure 90: Debris located north of clump weight. (Video 2022-06-08_13.43.09; 07:57).

2.4.4.10 Target NCL_SC_002

ROV dive	Dive Start Easting	Dive Start Northing	Interpretation	Dimensions	Distance from GEP (m)	Depth
31	698297.94	8616489.78	Single isolated object, possible debris or natural feature	Length: 1.00 Width: 0.40	11	14 m

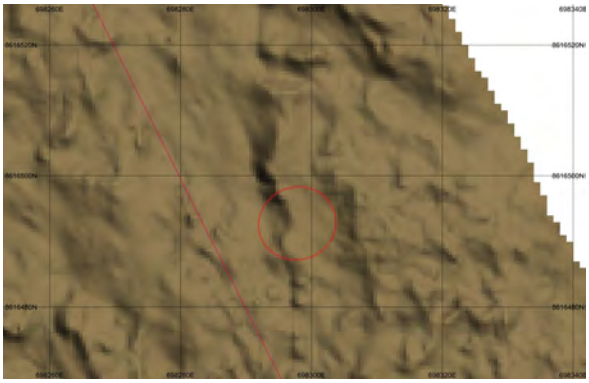


Figure 91: MBES image of Target NCL_SC_002

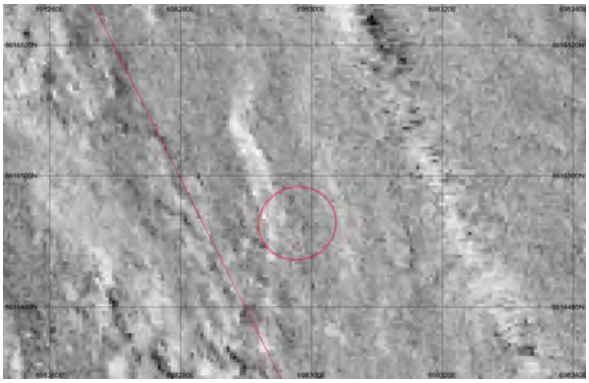


Figure 92: SSS image Target NCL_SC_002.

Inspection details for Target NCL_SC_002		
Date: 08-06-2022	Method: ROV	Tide: Ebbing
Distance and direction: Cross search pattern, 10m NESW		
Swim start (min): 1420	Swim end (min): 1440	Total time (min): 20
Depth: 14 m	Water visibility: 2 m – 3 m	Seabed visibility: Good

Target description: Dive methodology was repeated from previous dives. A clump weight with buoy was dropped on the target from the moving vessel. Once anchored, the ROV was placed in the water and followed the line down to the seabed. Once on bottom, a cross shaped search pattern was conducted, with 10m transects in each cardinal direction from the clump weight.

A small piece of possible debris was located 5m south of the clump weight. The object was long and thin, possibly aluminium if metal. After locating this object, the ROV lost the location of the clump weight and surfaced to locate the target again. After reaching the bottom again, the ROV swam north of the weight, and completed its cross-pattern search. No other cultural material was seen in the area.

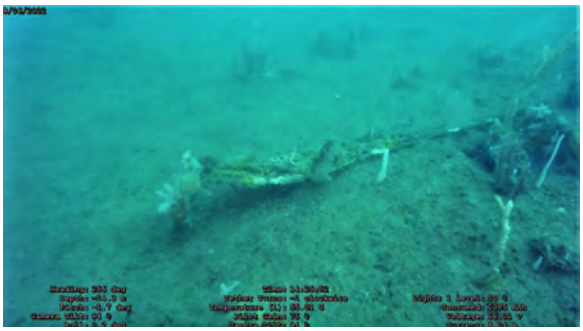


Figure 93: Possible debris located south of clump weight. (Video 2022-06-08_14.22.27; 03:23).

Figure 94: Natural feature north of clump weight. (Video 2022-06-08_14.22.27; 15:11).

3 ROV SURVEY SUMMARY

In total, 21 dives were attempted to locate and identify geophysical survey targets. Of these 21 dives, 3 were aborted due to poor conditions or issues with the ROV. Despite these failed attempts, ROV surveys were conducted on all 16 targets shortlisted for ROV survey.

Heritage Transects 1, 2, and 3 identified the remains of WWII anti-submarine net moorings near the entrance to Darwin Harbour. It was concluded based on these surveys that the northern and southern mooring trots (Transects 2 and 3) did not cross the proposed GEP route. It was noted that the northern end of the trot surveyed by Transect 2 was anchored with a potentially historical ships anchor, likely of cultural heritage significance.

ROV survey of the middle trot (Transect 1) identified mooring chains that did cross the proposed GEP route. However, it was also seen that a gap exists between sections of the chain, southeast of the location of Target 246, which was not located.

Individual dives on 10 isolated heritage targets identified 5 instances of natural features, not considered to be cultural in origin. Of the remaining 5, four are conclusively cultural, while one was inconclusive. The table below summarizes the results of the survey of these features.

Target ID	Likely identification	Cultural/Natural
142	Boulders	Natural
245	Rock rubble	Natural
241	Shallow depression	Natural
NCL_SC_031	Sand ripples	Natural
175	Narrow rock/coral ridge	Natural
174	Winch or windlass	Cultural
NCL_SC_016	Telegraph cable	Cultural
MA_007	Remains of barge	Cultural
MA_001	Buoy mooring and cable	Cultural
NCL_SC_002	Metal debris	Inconclusive

ANNEX A – DIVE LOG

Dive	Date	Objective of dive	Swim Start	Swim Finish	Total bottom time (min)
3	06/06/2022	T1_1	10:27	11:38	11
4	06/06/2022	T1_2	12:15	12:38	13
5	06/06/2022	T1_3	12:47	13:11	24
7	06/06/2022	Target 142	14:58	15:35	37
8	06/06/2022	T1_4	16:05	16:44	39
9	06/06/2022	Target 245	17:01	17:10	9
10	07/06/2022	T1_5	8:09	8:11	2
14	07/06/2022	T1_6	10:45	11:06	21
15	07/06/2022	T1_7	11:30	12:00	30
16	07/06/2022	T2_1	12:31	12:55	24
19	07/06/2022	Targets 241 and NCL_SC_031	14:53	15:29	36
20	07/06/2022	T3_1	15:58	16:26	28
21	07/06/2022	T2_2	16:46	17:02	16
22	08/06/2022	Target 175	7:18	7:34	16
23	08/06/2022	Target 175	7:48	8:10	22
24	08/06/2022	Target 174	8:26	8:41	15
25	08/06/2022	Target NCL_SC_016	8:53	9:00	7
26	08/06/2022	Target NCL_SC_016	9:07	9:33	26
29	08/06/2022	MA_007	12:56	13:12	16
30	08/06/2022	MA_001	13:38	13:58	20
31	08/06/2022	NCL_SC_002	14:20	14:40	20
Total Dives	21			Total bottom time	432

ANNEX B – VIDEO LOG

Dive	Name	File	Size (GB)	Length
3	2022-06-06_10.27.18	MKV	2.00	31:08
	2022-06-06_10.58.29	MKV	3.22	41:18
4	2022-06-06_12.24.46	MKV	0.68	12:37
5	2022-06-06_12.48.12	MKV	1.51	21:01
7	2022-06-06_15.00.03	MKV	0.68	13:47
8	2022-06-06_16.08.58	MKV	2.30	32:31
	2022-06-06_16.41.31	MKV	0.25	03:55
9	2022-06-06_17.02.18	MKV	0.45	07:53
10	2022-06-07_08.06.12	MKV	0.00	00:02
14	2022-06-07_10.46.37	MKV	0.79	16:17
15	2022-06-07_11.30.28	MKV	1.79	30:19
16	2022-06-07_12.31.43	MKV	1.86	23:41
19	2022-06-07_14.54.13	MKV	0.55	09:51
	2022-06-07_15.04.06	MKV	0.28	03:37
20	2022-06-07_15.56.55	MKV	2.30	29:18
21	2022-06-07_16.47.23	MKV	0.87	14:23
22	2022-06-08_07.19.04	MKV	0.68	15:45
23	2022-06-08_07.51.14	MKV	0.91	19:44
24	2022-06-08_08.26.18	MKV	0.79	14:40
25	2022-06-08_08.58.47	MKV	0.38	05:37
26	2022-06-08_09.06.58	MKV	1.28	24:43
29	2022-06-08_12.56.09	MKV	1.27	16:06
30	2022-06-08_13.43.09	MKV	1.17	14:50
31	2022-06-08_14.22.27	MKV	1.62	20:39

11 ANNEX B: CONSOLIDATED TARGET LIST

The table below is a consolidated list of all targets identified as potentially cultural from geophysical survey data review. Additionally, several known shipwrecks within the study area and anchoring corridor are included, as well as targets surveyed during ROV surveys (see main report, Section 7, and Annex A).

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
B	MA_001 *	697,628.20	8,617,803.70	Likely buoy mooring and cable	1	1	0.25	20	35
A	MA_007 *	695,763.20	8,621,695.50	Metal frame and debris	5	2	0.25	24	6
B	MA_028	693,130.70	8,624,923.90	Buried ferrous object near anti-sub net moorings	N/A	N/A	N/A	21	150
B	MA_031	698,180.90	8,616,372.60	Buried ferrous object	N/A	N/A	N/A	13	146
B	MA_037	701,335.50	8,613,704.20	Buried ferrous object	N/A	N/A	N/A	19	651
A	112	623 013.42	8 659 220.00	Single object of high relief. Possible debris related to I-124.	8	6	N/A	46	68
A	138	686 407.37	8 632 159.33	Mound associated with anchor scars	13	16	N/A	17	59
A	149	691 670.76	8 626 677.01	Unknown, may be related to pipeline or another cultural feature.	Total length: 258m Ind. Diameter: 5m	19	N/A	19	200
A	164*	693 038.56	8 625 231.53	Part of anti-submarine net mooring trot 18 FUGRO ID: NCL_SC_026	209	2	N/A	16	30
A	166*	693 399.74	8 624 898.55	Part of anti-submarine net mooring trot 16 FUGRO ID: NCL_SC_017, 018, 019	73	5	N/A	21	41

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	167*	693 085.69	8 625 121.75	Part of anti-submarine net mooring trot 17 Likely connected to Target ID: 164	3	3	N/A	16	76
A	191	696 438.36	8 620 800.13	Single object of high relief. Possible small boat.	8	3	N/A	19	73
A	210	701 140.90	8 613 958.61	Possible aircraft wreck or natural feature.	12	7	N/A	17	389
A	234	647 746.21	8 649 692.16	Single mound, indicating lone discarded object.	5	4	N/A	43	173
A	238	696 581.70	8 620 537.67	Possible scattered debris.	70	10	N/A	21	78
A	239	697 710.77	8 617 774.90	USAT *Mauna Loa*	124.97	16.46	N/A	19	90
A	240	691 578.22	8 626 925.25	Possible mooring block for anti-submarine defences	4	2	N/A	16	122
A	242	691 589.94	8 626 799.20	Steel wire rope and chain associated with anti-submarine defences. (boom net), UXO including mechanical fuses and fuse cones. (See Section 6.4)	23	13	N/A	17	186
A	243	693 188.00	8 624 746.00	Possible mooring block related to anti-submarine defences.	2	2	N/A	15	216
A	244*	693 196.00	8 625 167.00	Part of anti-submarine net mooring trot 18 FUGRO ID: NCL_SC_022, 023, 024, 025	120	5	N/A	22	50
A	248	693 131.66	8 624 925.53	Debris scatter, or possible anti-submarine net remains	Var.	Var.	N/A	16	150

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
B	NCL_SC_002*	698 297.94	8 616 489.78	Debris	1	0.4	N/A	17	11
B	NCL_SC_010	694 982.00	8 622 822.59	Linear debris, likely cable remains.	17	0.5	N/A	20	70
A	NCL_SC_016*	694 168.64	8 623 820.49	Cable, possible telegraph	3.5	1.6	N/A	24	40
B	NCL_SC_031*	691 780.61	8 626 909.95	Single isolated non-ferrous object, likely debris.	1.4	0.7	N/A	16	26
B	115	649 361.40	8 649 116.46	Shallow depressions with low relief object.	8	4	N/A	44	86
B	130	665 465.07	8 643 481.67	Possible debris scatter.	18	8	N/A	29	208
B	135	621 286.34	8 660 259.37	Likely natural feature, closest proximity target to I-124	62	58	N/A	48	143
B	136	622 455.26	8 659 969.89	Possible debris scatter or natural feature.	98	32	N/A	49	214
B	141	690 574.96	8 628 606.67	Debris or rocks FUGRO ID: NCL_SC_043, 044, 045, 046	53	20	N/A	30	137
A	174*	694 194.43	8 623 696.01	Winch or windlass with rope FUGRO ID: NCL_SC_013	5	4	N/A	24	16
B	192	696 253.89	8 620 643.48	Possible debris	24	22	N/A	14	147
B	196	696 859.94	8 619 902.39	Debris or rocks	9	6	N/A	19	53
B	233*	639 844.98	8 652 470.81	Triangular depression, Likely natural feature.	39	8	N/A	41	34
A	500	697,615.17	8,618,840.23	USAT Meigs	121.00	20.00	3.30	20	369
A	501	695,875.84	8,619,850.01	Medkhanun 3	25.00	8.00	7.00	19	847
A	502	695,698.81	8,620,246.53	Ham Luong	18.00	5.00	3.00	25	832
A	503	695,794.02	8,620,287.72	Song Saigon	40.00	10.00	5.00	24	728
A	504	695,778.93	8,620,381.31	John Holland Barge	38.00	15.00	5.00	25	700

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	505	693,287.42	8,623,844.84	Mandorah Queen	12.00	5.00	2.00	20	683
A	506	691,938.35	8,625,657.51	NR Diemen	29.00	5.00	0.00	8	642
A	573	692,508.78	8,625,489.01	Debris	26.00	15.00	0.50	17	295
A	574	691,574.41	8,626,791.47	WWII anti-sub boom net	41.00	21.00	1.00	21	209
A	575	691,518.71	8,626,801.77	Debris	10.00	6.00	0.75	20	245
B	576	689,856.12	8,628,847.08	Mound	7.00	6.50	0.40	25	268
B	577	689,412.76	8,629,288.62	Isolated object	4.00	4.50	0.50	24	263
B	578	685,439.11	8,632,096.37	Mound associated with trawl scar	8.00	4.50	0.40	17	603
A	579	689,314.84	8,630,473.13	Debris	20.00	9.00	1.30	31	592
B	580	689,842.70	8,630,171.05	Mound	5.00	4.00	1.50	30	691
A	581	691,692.88	8,627,659.36	Possible cable	312.00	2.50	1.40	31	431
A	583	692,918.80	8,626,550.93	Linear debris	11.00	2.00	1.50	39	682
A	584	692,936.90	8,626,417.56	Debris or boulder	7.00	6.00	3.50	39	613
A	588	693,982.49	8,624,331.38	Debris	8.00	4.00	2.50	35	165
A	585	694,508.35	8,624,088.70	Debris	9.00	3.00	0.50	32	472
B	586	694,770.88	8,624,269.65	Possible small boat or natural feature	17.00	4.00	1.25	35	791
A	587	695,753.15	8,623,106.77	Mooring block	3.00	2.50	0.80	33	852
A	589	696,110.51	8,621,995.74	Debris	17.00	7.00	2.50	33	452
A	590	696,133.59	8,621,994.69	Debris	4.50	2.50	2.00	33	470
A	591	696,472.78	8,621,975.02	Debris	6.40	6.20	1.50	32	727
A	592	696,535.45	8,621,187.11	Debris	8.50	2.70	1.30	25	345
A	593	696,548.46	8,621,272.90	Mooring block	1.40	1.40	0.75	25	399
A	594	697,090.00	8,620,464.24	Debris	3.50	3.00	1.75	25	513
A	595	697,563.09	8,620,256.32	Debris	6.50	4.20	1.75	32	845
A	597	698,035.82	8,617,894.98	Debris	3.00	3.00	2.00	20	443
B	598	697,030.36	8,617,864.23	Linear feature	59.00	2.00	0.75	12	504
B	599	697,055.70	8,617,918.12	Linear feature	24.00	2.00	0.75	13	462
B	600	697,036.34	8,618,057.64	Linear feature	33.00	2.00	1.00	16	434
A	601	696,815.85	8,619,144.52	Debris	40.00	8.00	0.50	19	286

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	602	696,751.52	8,619,156.36	Debris	24.00	11.00	0.75	16	343
A	603	696,112.03	8,619,639.40	Debris	8.00	6.60	3.00	14	729
B	604	696,043.52	8,619,624.92	Linear feature, log	18.70	2.40	1.00	13	797
B	605	696,000.91	8,619,629.09	Linear feature, log	15.80	2.40	0.50	13	833
B	606	696,032.94	8,619,598.74	Linear feature, log	13.00	2.40	0.75	13	818
B	607	696,362.60	8,619,654.65	Debris	7.00	6.50	1.00	12	497
A	609	696,003.49	8,621,145.27	Debris	16.00	7.50	3.00	21	132
B	610	695,614.51	8,621,498.95	Isolated object	3.30	1.50	0.60	18	244
A	611	693,064.64	8,624,298.00	Mooring block	1.70	1.70	0.50	17	599
A	612	693,132.32	8,624,265.69	Debris	3.00	2.50	0.90	18	568
A	620	692,571.44	8,624,809.47	Ant-sub net mooring	1.00	1.00	1.00	12	663
A	621	692,539.74	8,624,860.74	Ant-sub net mooring	1.00	1.00	1.00	15	656
A	622	692,523.80	8,624,892.44	Ant-sub net mooring	1.00	1.00	1.00	15	649
A	623	692,599.70	8,624,754.58	Ant-sub net mooring	1.00	1.00	1.00	11	674
A	624	692,709.75	8,624,594.89	Ant-sub net mooring	1.00	1.00	1.00	15	685
A	625	692,769.99	8,624,467.63	Ant-sub net mooring	1.00	1.00	1.00	10	716
A	626	692,749.61	8,624,525.87	Ant-sub net mooring	1.00	1.00	1.00	10	696
A	627	692,726.33	8,624,548.70	Ant-sub net mooring	1.00	1.00	1.00	11	700
A	628	692,147.90	8,624,971.06	Ant-sub net mooring	1.00	1.00	1.00	12	898
A	629	692,431.95	8,624,717.81	Ant-sub net mooring	1.00	1.00	1.00	7	829
A	630	692,412.02	8,624,771.61	Ant-sub net mooring	1.00	1.00	1.00	7	812
A	631	692,453.33	8,624,625.24	Ant-sub net mooring	1.00	1.00	1.00	9	869
A	632	692,922.97	8,624,532.76	Ant-sub net mooring	1.00	1.00	1.00	16	556
A	633	692,914.46	8,624,593.08	Ant-sub net mooring	1.00	1.00	1.00	16	525

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	634	692,897.79	8,624,648.33	Ant-sub net mooring	1.00	1.00	1.00	18	504
A	635	692,876.05	8,624,702.14	Ant-sub net mooring	1.00	1.00	1.00	15	488
A	636	692,763.55	8,624,903.58	Ant-sub net mooring	1.00	1.00	1.00	11	453
A	637	692,729.14	8,624,950.23	Ant-sub net mooring	1.00	1.00	1.00	11	452
A	638	692,816.54	8,624,826.14	Ant-sub net mooring	1.00	1.00	1.00	17	459
A	639	693,066.90	8,624,638.82	Ant-sub net mooring	1.00	1.00	1.00	20	377
A	640	693,040.27	8,624,691.00	Ant-sub net mooring	1.00	1.00	1.00	18	365
A	641	693,020.88	8,624,746.07	Ant-sub net mooring	1.00	1.00	1.00	19	347
A	642	692,944.62	8,625,014.99	Ant-sub net mooring	1.00	1.00	1.00	22	242
A	643	692,919.53	8,625,081.20	Ant-sub net mooring	1.00	1.00	1.00	15	221
A	644	692,908.66	8,625,150.86	Ant-sub net mooring	1.00	1.00	1.00	15	187
A	645	692,905.94	8,625,190.98	Ant-sub net mooring	1.00	1.00	1.00	16	164
A	646	693,039.04	8,625,225.45	Ant-sub net mooring	1.00	1.00	1.00	19	38
A	647	693,058.79	8,625,182.69	Ant-sub net mooring	1.00	1.00	1.00	18	49
A	648	693,076.54	8,625,127.44	Ant-sub net mooring	1.00	1.00	1.00	19	69
A	649	693,093.03	8,625,071.10	Ant-sub net mooring	1.00	1.00	1.00	18	90
A	650	693,205.80	8,624,728.36	Ant-sub net mooring	1.00	1.00	1.00	17	213
A	651	693,234.87	8,624,680.26	Ant-sub net mooring	1.00	1.00	1.00	18	222
A	652	693,144.21	8,624,841.13	Ant-sub net mooring	1.00	1.00	1.00	18	191
A	653	693,182.07	8,624,784.25	Ant-sub net mooring	1.00	1.00	1.00	19	196
A	654	693,311.23	8,624,817.58	Ant-sub net mooring	1.00	1.00	1.00	27	75
A	655	693,293.93	8,624,874.10	Ant-sub net mooring	1.00	1.00	1.00	26	53

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	656	693,197.83	8,625,161.77	Ant-sub net mooring	1.00	1.00	1.00	26	48
A	657	693,162.23	8,625,272.64	Ant-sub net mooring	1.00	1.00	1.00	21	88
A	658	693,173.46	8,625,217.02	Ant-sub net mooring	1.00	1.00	1.00	21	63
A	659	693,400.45	8,624,893.93	Ant-sub net mooring	1.00	1.00	1.00	24	42
A	660	693,420.92	8,624,841.76	Ant-sub net mooring	1.00	1.00	1.00	22	24
A	661	693,376.72	8,624,944.02	Ant-sub net mooring	1.00	1.00	1.00	24	56
A	662	693,282.43	8,625,202.62	Ant-sub net mooring	1.00	1.00	1.00	28	140
A	663	693,307.79	8,625,145.38	Ant-sub net mooring	1.00	1.00	1.00	25	125
A	664	693,254.26	8,625,282.33	Ant-sub net mooring	1.00	1.00	1.00	27	167
A	665	693,362.50	8,625,014.22	Ant-sub net mooring	1.00	1.00	1.00	26	88
A	666	693,460.95	8,625,089.13	Ant-sub net mooring	1.00	1.00	1.00	26	211
A	667	693,555.33	8,624,959.96	Ant-sub net mooring	1.00	1.00	1.00	25	203
A	668	693,650.62	8,624,848.92	Ant-sub net mooring	1.00	1.00	1.00	27	204
A	669	693,506.97	8,624,814.32	Ant-sub net mooring	1.00	1.00	1.00	21	72
A	670	693,465.48	8,624,923.37	Ant-sub net mooring	1.00	1.00	1.00	25	111
A	671	693,643.69	8,624,929.98	Ant-sub net mooring	1.00	1.00	1.00	26	251
A	672	693,469.78	8,625,242.93	Ant-sub net mooring	1.00	1.00	1.00	28	313
A	673	693,711.60	8,625,070.97	Ant-sub net mooring	1.00	1.00	1.00	32	394
A	674	694,135.50	8,625,135.19	Ant-sub net mooring	1.00	1.00	1.00	36	759
A	675	694,161.68	8,625,283.10	Ant-sub net mooring	1.00	1.00	1.00	36	875
A	676	694,183.69	8,625,228.03	Ant-sub net mooring	1.00	1.00	1.00	36	856
A	677	694,250.36	8,625,094.43	Ant-sub net mooring	1.00	1.00	1.00	34	821

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	678	693,923.28	8,625,184.46	Ant-sub net mooring	1.00	1.00	1.00	34	629
A	679	693,952.90	8,625,141.07	Ant-sub net mooring	1.00	1.00	1.00	28	624
A	680	693,970.93	8,625,083.92	Ant-sub net mooring	1.00	1.00	1.00	28	601
A	681	693,751.64	8,625,475.17	Ant-sub net mooring	1.00	1.00	1.00	35	678
A	682	693,775.01	8,625,422.23	Ant-sub net mooring	1.00	1.00	1.00	35	664
A	683	693,794.64	8,625,355.29	Ant-sub net mooring	1.00	1.00	1.00	35	638
A	684	693,902.95	8,625,554.38	Ant-sub net mooring	1.00	1.00	1.00	36	846
A	685	694,101.63	8,625,224.18	Ant-sub net mooring	1.00	1.00	1.00	35	791
A	686	693,979.35	8,625,516.11	Ant-sub net mooring	1.00	1.00	1.00	34	883
A	687	693,951.72	8,625,500.98	Ant-sub net mooring	1.00	1.00	1.00	33	852
A	688	693,595.12	8,625,397.09	Ant-sub net mooring	1.00	1.00	1.00	36	506
A	689	693,625.83	8,625,262.22	Ant-sub net mooring	1.00	1.00	1.00	34	448
A	690	693,861.92	8,624,914.00	Ant-sub net mooring	1.00	1.00	1.00	33	408
A	691	694,235.64	8,625,020.33	Ant-sub net mooring	1.00	1.00	1.00	35	763
A	692	694,004.85	8,624,910.74	Ant-sub net mooring	1.00	1.00	1.00	34	515
A	693	693,790.27	8,625,076.31	Ant-sub net mooring	1.00	1.00	1.00	33	458
A	694	692,680.70	8,625,066.80	Ant-sub net mooring	1.00	1.00	1.00	16	418
A	695	692,486.05	8,624,972.60	Ant-sub net mooring	1.00	1.00	1.00	16	630
A	696	692,274.19	8,624,850.32	Ant-sub net mooring	1.00	1.00	1.00	7	872
A	697	692,370.93	8,624,932.20	Ant-sub net mooring	1.00	1.00	1.00	10	746
A	698	692,376.54	8,624,652.46	Ant-sub net mooring	1.00	1.00	1.00	6	913
A	699	693,479.77	8,625,162.13	Ant-sub net mooring	1.00	1.00	1.00	26	271

Target ID		Datum: GDA94 CRS: UTM Zone 52S		Interpretation	Dimensions (m)			Depth (m)	Distance from pipeline (m)
		Easting	Northing		Length	Width	Height		
A	700	693,373.52	8,625,219.83	Ant-sub net mooring	1.00	1.00	1.00	25	223
A	701	692,476.81	8,624,552.19	Ant-sub net mooring	1.00	1.00	1.00	9	895
A	702	692,545.01	8,624,451.33	Ant-sub net mooring	1.00	1.00	1.00	13	903
A	703	692,536.68	8,624,530.67	Ant-sub net mooring	1.00	1.00	1.00	14	861
A	704	692,512.14	8,624,583.21	Ant-sub net mooring	1.00	1.00	1.00	10	848
A	705	692,731.65	8,624,460.66	Ant-sub net mooring	1.00	1.00	1.00	10	750
A	706	693,612.40	8,625,501.30	Ant-sub net mooring	1.00	1.00	1.00	37	584
A	707	693,639.40	8,625,450.30	Ant-sub net mooring	1.00	1.00	1.00	37	414
A	708	693,667.30	8,625,396.10	Ant-sub net mooring	1.00	1.00	1.00	36	435
A	709	693,801.20	8,625,027.90	Ant-sub net mooring	1.00	1.00	1.00	33	562
A	710	693,812.30	8,624,981.60	Ant-sub net mooring	1.00	1.00	1.00	32	576

*Targets with starred ID's have been visually inspected during ROV surveys (see Section 7).

Appendix H Santos' environment consequence descriptors

Excerpt from Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004).

		I	II	III	IV	V	VI
		Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
	Severity description	Negligible No impact or 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 impact to regional population, industry or ecosystem factors
Environmental Receptors	Fauna In particular, EPBC Act listed threatened/migratory fauna or *WA Biodiversity Conservation Act 2016* specially 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. Major reduction in area of occupancy of species. 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[35], habitat within a protected area; habitats that include benthic primary producers[36] and/or epi-fauna[37]	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 approximately two years (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 widespread 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.
	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 significant 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. Introduce 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 of 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 of 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 of 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 of 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.

[35] As defined by the Department of Agriculture, Water and Environment
[36] Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves
[37] Fauna attached to the substrate including sponges, soft corals and crinoids.