Santos

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline

Operations Environment Plan Summary (onshore and State waters)

May 2025

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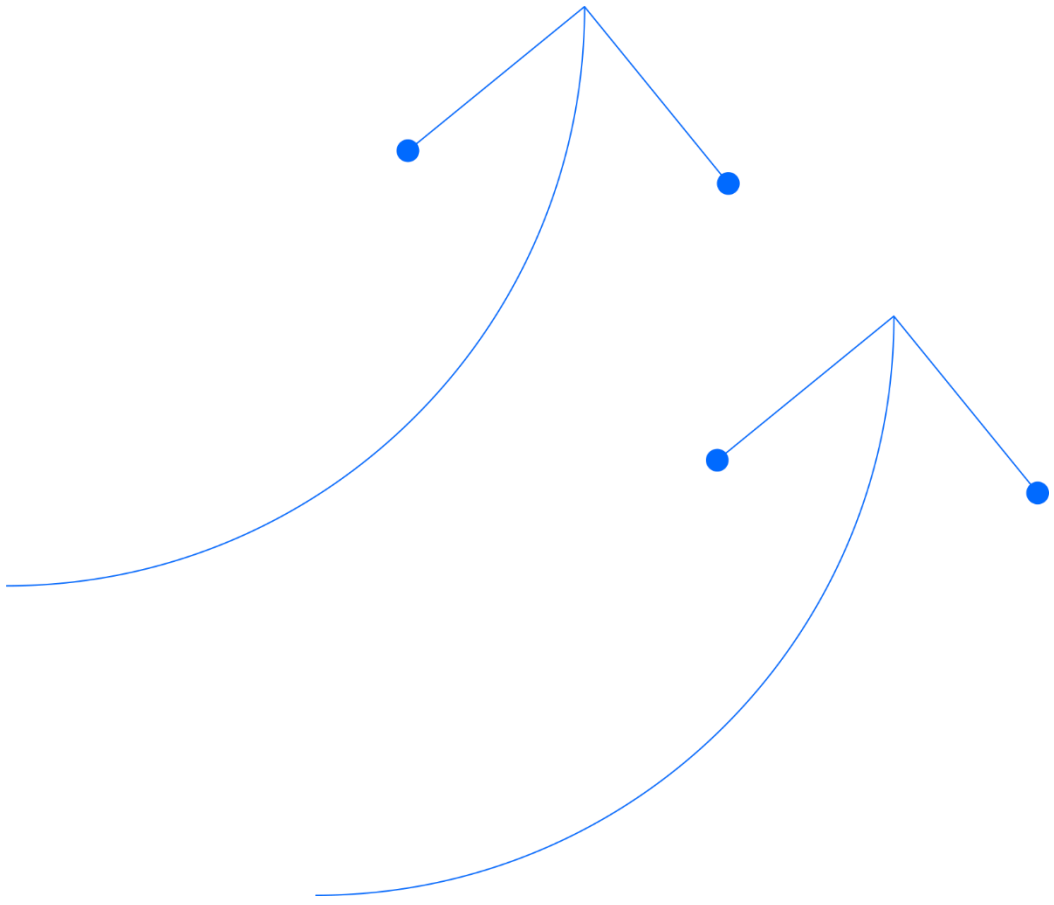

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Terms

Term	Definition
°C	Celsius
ABARES	Australian Bureau of Agricultural and Resource Economics
AEL	Apache Energy Ltd.
AES	Astron Environmental Services
AHO	Australian Hydrographic Office
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Sciences Association
APPEA	Australian Petroleum Production and Exploration Association
AUV	Autonomous Underwater Vehicle
BIA	Biologically Important Area
BTEX	Benzene, toluene, ethylbenzene and xylene
CALM	Department of Conservation and Land Management (Western Australia)
CCS	Carbon Capture and Storage
CMC	Change Management Control (engineering)
CMMS	Computerised maintenance management system
CoA	Commonwealth of Australia
CP	Cathodic protection
CSB	Commonwealth State Boundary
CTD	Conductivity, temperature, and depth
CTD	Conductivity, temperature, and depth profiler
DAFF	Department of Agriculture, Fisheries and Forestry (formerly Department of Agriculture and Water Resources)
DAH	Dissolved aromatic hydrocarbon
DAWE	Department for Agriculture, Water and Environment (previously DoEE)
DAWR	Department of Agriculture and Water Resources (now Department of Agriculture, Fisheries and Forestry)
dB	decibel
DBCA	Department of Biodiversity, Conservation and Attractions (Western Australia)
DBNGP	Dampier to Bunbury natural gas pipeline
DC	Devil Creek
DCCEEW	Department of Climate Change, Energy, the Environment and Water (previously DAWE, DoEE)
DCGP	Devil Creek gas plant
DEC	Department of Environment and Conservation (now DBCA) (Western Australia)
DECC	Department of Energy and Climate Change
DEMIRS	Department of Energy, Mining, Industry, Resources and Safety (formerly DMIRS)
DER	WA Department of Environment Regulation (formerly DEC) (Western Australia)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (previously Department of Environment and Water, Department of Environment and Heritage)
DMIRS	Department of Mining, Industry, Resources and Safety (formerly DMP) (Western Australia)

Term	Definition
DMP	Department of Mines and Petroleum (Western Australia)
DMP	Department of Mines and Petroleum (now DEMIRS) (Western Australia)
DoEE	Department of the Environment and Energy (now DAWE)
DoF	Department of Fisheries (now DPIRD) (Western Australia)
DoT	Department of Transport (Western Australia)
DPIRD	Department of Primary Industry and Regional Development (formerly DoF) (Western Australia)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DSV	Diving support vessel
DWER	Department of Water and Environmental Regulation (formerly DER) (Western Australia)
EMBA	Environment that may be affected
EP	Environment Plan
EP Act	Environment Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPO	Environmental performance objective
EPS	Environmental performance standard
ESD	emergency shutdown
ESDV	emergency shutdown valves
g/m^2	grams per square meter
GDA	Geocentric Datum of Australia
GHG	Greenhouse gases
GVI	General visual inspection
HDD	Horizontally directionally drilled
HEV	High environmental value
HEVA	High Exposure Value Area
HP	Horse power
HSE	Health, safety and environment
Hz	Hertz
IAPP	International Air Pollution Prevention
IBC	Intermediate bulk container
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMMR	Inspection Maintenance Monitoring and Repair
IMR	Inspection, maintenance, repair
IMS	Invasive marine species
IMSMP	Invasive marine species management plan
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environmental Conservation Association
IRP	Industry Recommended Practice
IUCN	International Union for Conservation of Nature – World Conservation Union
JRCC	Joint Rescue Coordination Centre
KEF	Key ecological feature
KEFs	Key ecological features
kHz	Kilohertz

Term	Definition
km	Kilometre
KP	Kilometre point
kPa	kilopascal
kW	kilowatts
L	Litre
LED	Light-emitting diode
LEMS	Lifting equipment management system
LF	Low frequency
m	Metre
m/s	Metre per second
m^2	Square metre
m^3	Cubic metre
m^3/hr	Cubic metre per hour
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multi-beam echo sounder
MCS	Maximum credible spill
MDO	Marine diesel oil
MEVA	Moderate Exposure Value Area
MF	Mid-frequency
MLWM	Mean low water mark
MMSCFD	Million standard cubic feet per day
MNES	matters of national environmental significance
MoC	Management of change
MOP	Marine Oil Pollution (plan)
MOU	Memorandum of Understanding
MPNMP	Marine Parks Network Management Plan
MPRA	Marine Parks and Reserves Authority
MS	Ministerial Statement
MSA	Master Services Agreement
MSDS	Material safety data sheet
NEBA	Net Environmental Benefit Analysis
NMFS	National Marine Fisheries Service
NMSC	National Marine Safety Committee
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORM	naturally occurring radioactive material
NRC	National Research Council
NWS	North West Shelf
ODS	Ozone-depleting substances
OEPA	Office of the EPA
OPEP	oil pollution emergency plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OSRL	Oil Spill Response Limited

Term	Definition
P(SL)(E)R	Petroleum (Submerged Lands) (Environment) Regulations
PAHs	polycyclic aromatic hydrocarbons
PCS	process control systems
PEC	priority ecological communities
PIC	person in charge
PIMP	pipeline integrity management plan
PK	zero-to-peak pressure level
PMST	protected matters search tool
POLREP	Harmful substances report
ppb	Parts per billion
ppm	Parts per million
PSAP	Performance Standard Assurance Plans
PSV	Pressure Safety Valves
PSZ	Petroleum safety zone
PTS	Permanent threshold shift
ROTV	Remotely operated (underwater) towed vehicle
ROV	Remotely operated (underwater) vehicle
RPS	Rural Planning Services
SBES	Single-beam echo sounder
SBP	Sub-bottom profilers
SCFM	Standard cubic feet per minute
SDS	Safety data sheet
SEL	Sound Exposure Level
SIS	Safety Instrument Systems
SITREP	Situation Report
SMPEP	Shipboard marine pollution emergency plan
SOLAS	Convention on Safety of Life at Sea, 1974
SOPEP	Shipboard oil pollution emergency plan
SPL	Sound Pressure Level
SSS	Side scan sonar
TBC	Thermal barrier coating
TTS	Temporary threshold shift
UAV	Unmanned Aerial Vehicle (drone)
WA	Western Australia
WAFIC	Western Australia Fishing Industry Council
WAOWRP	WA Oiled Wildlife Response Plan (Western Australia)
WDCS	Whale and Dolphin Conservation Society
WHP	Wellhead platform
YACMAC	The Yaburara and Coastal Mardudhnuera Aboriginal Corporation
µPa	Micropascal

1. Introduction

Santos WA Northwest Pty Ltd (Santos) is the operator on behalf of Santos (BOL) Pty Ltd and Santos Devil Creek Pty Ltd of the Devil Creek Gas Plant (DCGP) and associated Devil Creek (DC) gas supply pipeline (DC supply pipeline). The DCGP is located approximately 45 km southwest of Karratha, Western Australia (WA) that ties into the offshore Reindeer gas field via the DC supply pipeline.

The scope of this Environment Plan (EP) comprises all activities (as described in this EP) that are associated with the operation and future preservation of the WA State waters (permit TPL20) and onshore (permit PL81) sections of the DC supply pipeline and the onshore Devil Creek sales gas export pipeline (DC sales gas pipeline) from the DCGP to the Dampier to Bunbury Natural Gas Pipeline (DBNGP) (permit PL86). These are collectively referred to as the Devil Creek pipelines (DC pipelines). The DC pipelines are within State waters and onshore WA and comprise:

- The approximately 48 km long State waters section of the DC supply pipeline, from kilometre points (KPs) 0 at the mean low water mark to 48.3 where the DC supply pipeline crosses into State waters
- The approximately 11 km long onshore section of the DC supply pipeline, buried underground, from KP0 at the mean low water mark to KP11.156 at the DCGP
- The approximately 40 m long onshore DC sales gas pipeline, buried underground, from the DCGP to the DBNGP. This is illustrated in Figure 1-1.

The Reindeer wellhead platform and associated wells feed into the Commonwealth waters section of the DC supply pipeline. This infrastructure is collectively known as the Reindeer facilities which is located in Commonwealth jurisdiction and is outside the scope of this EP. The environmental management of the DCGP is outside of the scope of this EP and is covered under the *Devil Creek Operations Environmental Management Plan* (DC-40-RI-00021).

1.1 Transition to preservation

The Reindeer facility and DC pipelines are approaching the end of their economically viable production life and are expected to cease production in mid-2025. As part of the five-year revision, this EP has been updated to include Cessation of Production (CoP) and preservation activities. The CoP phase commences when the facility reaches its end of field life and has been shut-in and depressurised. The DC supply pipeline will then be cleaned and flushed of residual hydrocarbons and left in a preserved state for future phases (Section 2.8).

In anticipation of the CoP, Santos is assessing options to repurpose the DC supply pipeline for CSS or other purposes. If repurposing does not occur the DC pipelines will be decommissioned. Information on planning of repurposing and decommissioning of the DC pipelines is provided in Sections 2.10 and 2.11.

The DC pipelines will remain in place ‘preserved’ during the CoP phase that will continue until a decision on pipeline repurposing or decommissioning occurs. CCS and decommissioning activities are not included in the scope of this EP and will be covered in future EPs.

1.2 Scope of this Environment Plan

The scope of this EP applies to both the operations phase and CoP as outlined in Section 2 and, in summary includes the following:

- Operations phase:
  - The ongoing presence of infrastructure onshore and offshore on title
  - Operation of the DC supply pipeline in State waters and the DC sales gas pipeline
  - IMMR activities described below may also be undertaken during the operations phase.
- CoP (preservation) phase:
  - commences when facility reaches the end of field life and is shut in and depressurised
  - the DC supply pipeline is flushed and filled with preservation fluid or an inert gas such as nitrogen (N2)
  - the DC supply pipeline remains filled with preservation fluid or inert gas (e.g. Nitrogen (N2))
  - the DC sales gas pipeline freed of hydrocarbons and depressurised
  - the DC pipelines will remain in preservation phase until a decision is made to either repurpose the pipelines or decommission all, or part of the facilities

  - IMMR activities described below may also be undertaken during the preservation phase to maintain the integrity of the facilities.

- Inspection, maintenance, monitoring and repair (IMMR) which will be undertaken during the Operations or CoP phase:
  - DC supply pipeline integrity and corrosion management
  - Subsea, pipeline and seafloor imaging surveys
  - Subsea, pipeline and seafloor visual and sampling surveys
  - Onshore pipeline surveys and monitoring
  - Maintenance and repair activities.

The following activities are outside the scope of this EP and will either be addressed in other EPs and/or will be addressed through regulatory authorisation processes in other jurisdictions:

- DC pipelines reuse for CCS or other purposes
- DC pipelines decommissioning.

Decommissioning of the DCGP which is classified as a Major Hazard Facility (MHF) will be undertaken in accordance with a separate assessment process.

1.3 Purpose of this environment plan

P(SL)(E)R 2012 Requirements
Regulation 20(1)
The operator of a petroleum activity must submit to the Minister a proposed revision of the environment plan for the petroleum activity at least 14 days before the end of each period of 5 years, commencing on the latest of the following: • the day on which the environment plan is first approved under regulation 11 by the Minister; • the day on which a proposed revision of the environment plan submitted under this regulation is approved under regulation 11 by the Minister; • for a revision of an environment plan submitted under regulation 18 or 19 – the day (if any) notified by the Minister under subregulation (2). Penalty: a fine of $10,000.
Regulation 20(2)
For subregulation (1)(c), the Minister may notify the operator that the effect of a revision of an environment plan submitted under regulation 18 or 19 is that the period of 5 years mentioned in subregulation (1) starts on the day specified in the notification.

The operation of the DC Pipelines has been managed under the *Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (Onshore & State Waters)* (EA-14-RI-10001) (this EP), originally accepted on 28 August 2014 by the then Department of Mines and Petroleum (DMP), now the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS). A revision to this EP was accepted by the then Department of Mines Industry Regulation and Safety (DMIRS) on the 11 June 2020.

As the five-year validity period of this EP is due to expire, Santos has revised the EP in accordance with regulation 20 of the Petroleum (Submerged Lands) (Environment) Regulations (P(SL)(E)R) 2012 for acceptance by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).

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, in line with the principles of ecologically sustainable development (ESD). The EP provides an implementation strategy that will be used to measure and report on environmental performance during planned activities and unplanned events to ensure impacts and risks are continuously reduced to ALARP and are at an acceptable level. The environmental management of the activity described in the EP complies with the Santos Environment, Health & Safety Policy (Appendix A) and with all relevant legislation (Appendix B). This EP documents and considers all relevant stakeholder consultation.

1.4 Environment plan validity

In accordance with Regulation 20, this EP remains valid from the date of DEMIRS acceptance and for a period of five years. Until acceptance, the in-force EP continues to be valid.

Santos may revise the EP following its acceptance by DEMIRS, using the MoC process described in Section 8. Any changes made under this process will not affect the validity of this EP.

1.5 Operator

1.5.1 Details for the operator

Santos WA Northwest Pty Ltd (Santos) is the operator on behalf of Santos (BOL) Pty Ltd and Santos Devil Creek Pty Ltd of the Devil Creek Gas Plant (DCGP) and associated Devil Creek (DC) gas supply pipeline (DC supply pipeline). Santos WA Northwest Pty Ltd is the operator undertaking the activity within permit areas TPL20, PL81 and PL86. Operator details are provided in Table 1-1

Table 1-1: Operator details

Permit	Operator	ACN	% Interest	Address
TPL20	Santos WA Northwest Pty Ltd (Operator)	009 140 854	55	Level 7, 100 St Georges Terrace, Perth WA 6000
	Santos (BOL) Pty Ltd	000 670 575	45	
PL81	Santos WA Northwest Pty Ltd (Operator)	009 140 854	55	
	Santos (BOL) Pty Ltd	000 670 575	45	
PL86	Santos WA Northwest Pty Ltd (Operator)	009 140 854	55	
	Santos Devil Creek Pty Ltd	634 285 984	45	

1.5.2 Details for nominated liaison person

Details for Santos WA Northwest Pty Ltd's nominated liaison person for the activity are as follows:

Name: Dawn MacInnes

Business address: Level 7, 100 St Georges Terrace, Perth, WA 6000

Telephone number: (08) 6218 7100

Email address: offshore.environment.admin@santos.com

Additional information about Santos and its operations can be obtained from the website at: www.santos.com.

1.5.3 Notification procedure in the event of changed details

If there is a change in the operator, the operator's nominated liaison person or the contact details for the operator or liaison person, Santos will notify DEMIRS in writing and provide the updated details.

1.6 Environmental management framework

P(SL)(E)R 2012 Requirements
Regulation 14(6)
The environment plan must describe the requirements that a) apply to the petroleum activity under legislation (including conditions imposed under legislation), international conventions or agreements, or applicable codes of practice; and b) are relevant to the environmental management of the petroleum activity.

The activity will be conducted in accordance with Santos' Environment Health and Safety Policy (Appendix A) and Santos Management System (Section 8.1). In addition, there are a number of Commonwealth and Western Australian Acts/Regulations and international agreements and conventions relevant to the activity, as described in Appendix B.

Sections 5, 6 and 7 reflect the Environment Health and Safety Policy, detailing and evaluating impacts and risks from planned and unplanned events and providing control measures with set performance outcomes, standards and measurement criteria to ensure environmental performance is achieved.

1.6.1 Relevant environmental legislation

1.6.1.1 International legislation

Australia is signatory to numerous international conventions and agreements that obligate the Commonwealth government to prevent pollution and protect specified habitats, flora and fauna. Those that have been considered during development of this EP are detailed in Appendix B.

1.6.1.2 Commonwealth legislation

In the event of DC supply pipeline loss of integrity or a vessel collision, there is the potential for the spill to impact on Commonwealth waters.

Relevant Commonwealth legislation is detailed in Appendix B.

1.6.1.3 State legislation

P(SL)(E)R 2012 require that legislation relevant to the proposed activities be described in the EP. This section addresses the key legislation that has informed the preparation of this EP. Additional guidelines, requirements and the relevant State, Commonwealth and International legislation that apply to the proposed activities in State waters have been identified in Appendix B. This EP has been prepared in accordance with the:

- P(SL)(E)R 2012
- Petroleum Pipelines (Environment) Regulations 2012

The above legislation provides the regulatory framework for the exploration and production of petroleum resources located onshore and in State marine waters, including the territorial sea around State islands.

1.6.1.4 State Policy and Guidelines

Planning for decommissioning has commenced for the state portion of the DC supply pipeline and the '*Policy for Decommissioning of Petroleum and geothermal energy, property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* (DEMIRS, 2024) has been considered. This policy outlines DEMIRS position for decommissioning of infrastructure onshore and in state coastal waters pursuant to the P(SL) (E)R 2012 and the Petroleum Pipelines (Environment) Regulations 2012.

DEMIRS position on decommissioning is guided by the following principles:

- Early planning, continual review and preparation is critical to decommissioning success
- Progressive decommissioning should be undertaken as early as possible in the development phase
- Decommissioning of facilities is considered on a case by case basis but the end goal is complete removal of infrastructure and return of site to agreed state.

The *Decommissioning of petroleum and geothermal energy property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* guideline (DEMIRS, 2024B), provides guidance to operators on how to address DEMIRS decommissioning expectations. The guidelines also provide an outline on information requirements for decommissioning EPs.

1.6.1.5 Existing regulatory requirements

This section describes the existing regulatory requirements applicable to the DC pipelines. The DC pipelines are located within the WA State jurisdictional boundary and therefore are subject to State legislation. The relevant legislation is summarised in Figure 1-1.

The *Environment Protection Act 1986* (EP Act) requires all petroleum activities with the potential to cause significant environment harm to be referred to the Office of the Environment Protection Authority (OEPA). The project was referred to the OEPA and approved on 9 July 2009 (Ministerial Statement No. 795 [MS 795]). The conditions associated with this ministerial statement are not relevant to this EP due to their applicability during construction and decommissioning activities (which are not included in this EP); or the commitments are considered complete by the OEPA.

Santos will not be referring this activity under Part IV of the *Environment Protection Act 1986* or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as the activities relate to existing facilities and no significant environmental impacts or risks have been identified.

Legislation, best practice guidelines and management procedures relevant to this EP are detailed in Appendix B.

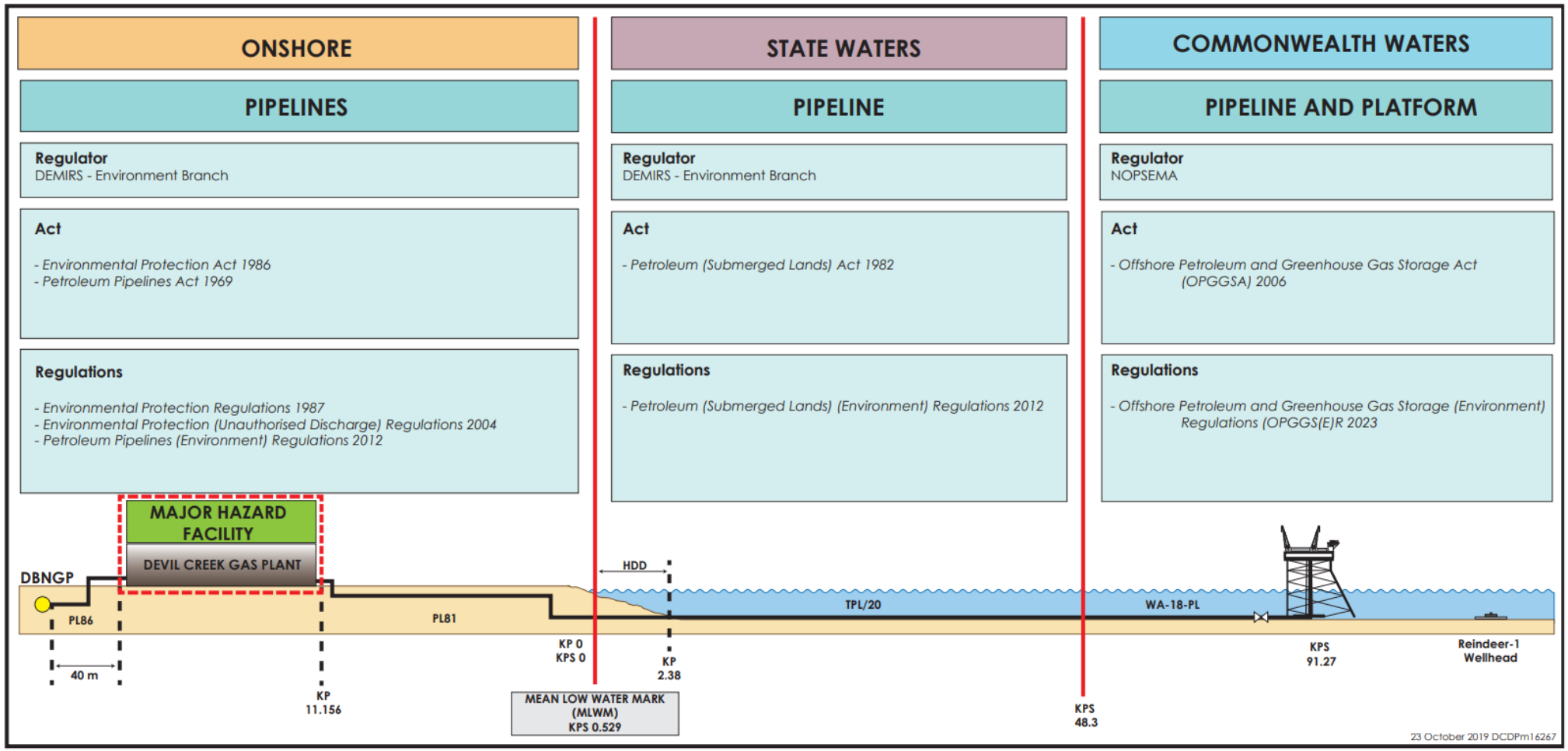


Figure 1-1: Pipeline licence tenure, environmental regulation authority and key applicable legislation relevant to this EP (June 2024)

2. Activity description

P(SL)(E)R 2012
Regulation 14(1)
The environment plan must include a comprehensive description of the petroleum activity including the following: • The location or locations of the petroleum activity • Details of the construction and layout of any facility • A description of the operational details of the petroleum activity and proposed timetables • Any additional information relevant to consideration of the environmental impacts and environmental risks of the petroleum activity.

2.1 Location

The section of the DC supply pipeline in state waters is 48.3 km in length and extends from the Commonwealth State Boundary (CSB) to the shoreline at Gnoorea Point. The DC supply pipeline is located approximately 12 km west of the Dampier Archipelago at the closest point. The DC supply pipeline then feeds into the DCGP, which is located approximately 10 km inland from Gnoorea Point and Forty Mile Beach. The DCGP is adjacent to Forty Mile Beach Road and is in close proximity to the intersection of Forty Mile Beach Road with the Northwest Coastal Highway.

The portion of the DC sales gas pipeline which forms part of the scope of this EP extends 40 m underground from the DCGP lease boundary to the DBNGP tie-in.

Coordinates of key locations are provided in Table 2-1. The location of the field is shown in Figure 2-2.

Table 2-1: Coordinates for the key DC pipelines locations

Infrastructure Location	Coordinates (Datum/Projection: GDA 94 Zone 50)	
	Latitude	Longitude
Gnoorea Point	20°50’17.95”S	116°20’44.82”E
Horizontal Directionally Drilled (HDD) Crossing (DC supply pipeline)	20°49’29.891”S	116°21’07.517”E
CSB (DC supply pipeline)	20° 24' 39.4421" S	116° 20' 08.5617" E
DC sales gas pipeline end of Santos ownership [(last point before tying in to DBNGP	20° 54' 22.3210" S	116° 25' 11.8917" E

2.1.1 Operational area

The operational area is shown in Figure 2-1 and Figure 2-2, comprising of:

- A 250 m buffer either side of the State waters section of the DC supply pipeline (from the CSB to the shoreline line at Gnoorea Point)
- A 50 m buffer either side of the onshore section of the DC supply pipeline (from Gnoorea Point to the DCGP)
- A 50 m buffer either side of the DC sales gas pipeline (from the DCGP to the DBNGP).

The extent of the operational area has been defined based on the physical footprint of the activities detailed in this EP. There will be no planned activities outside the operational area.

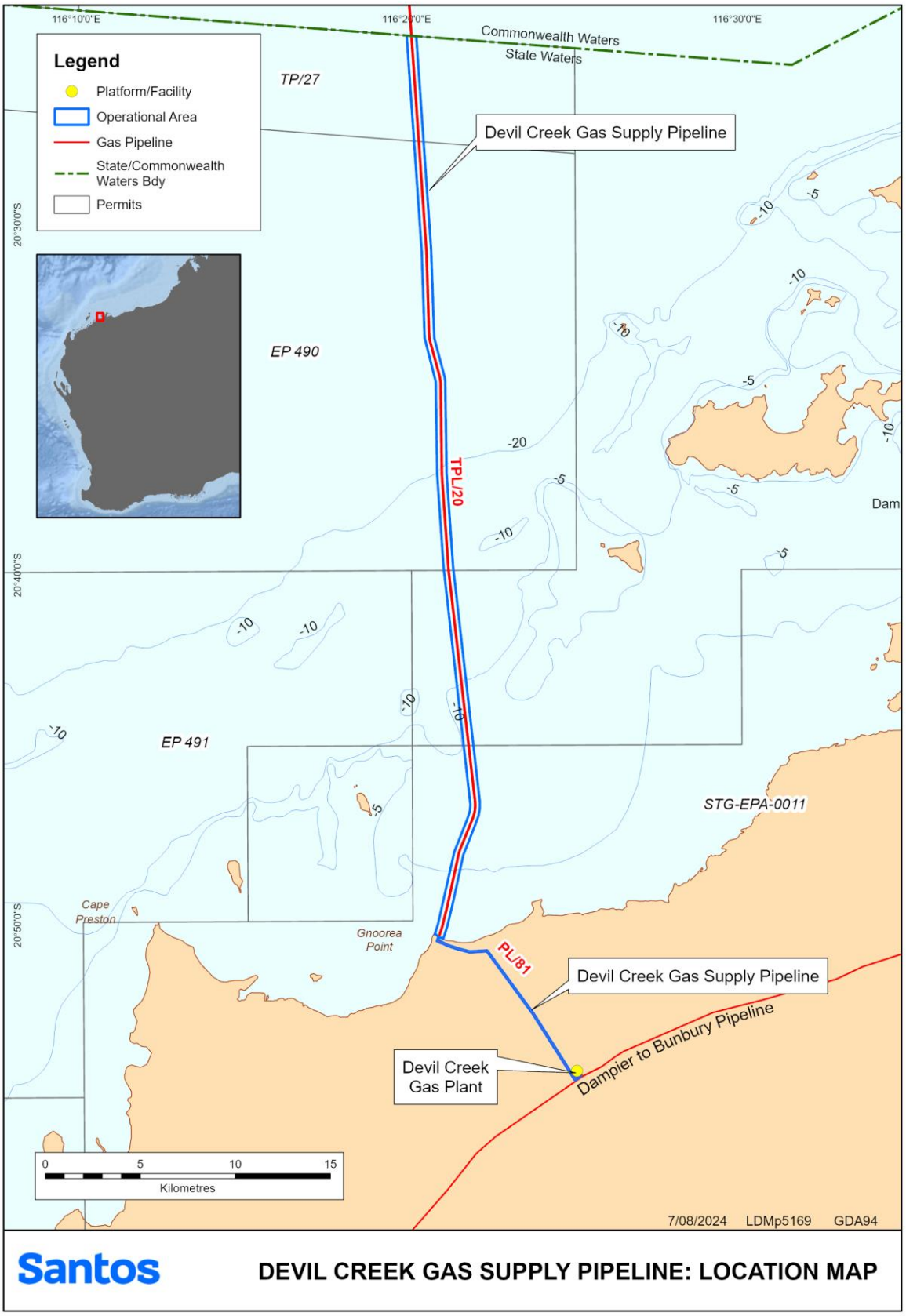


Figure 2-1: Devil Creek supply pipeline in State Waters and onshore

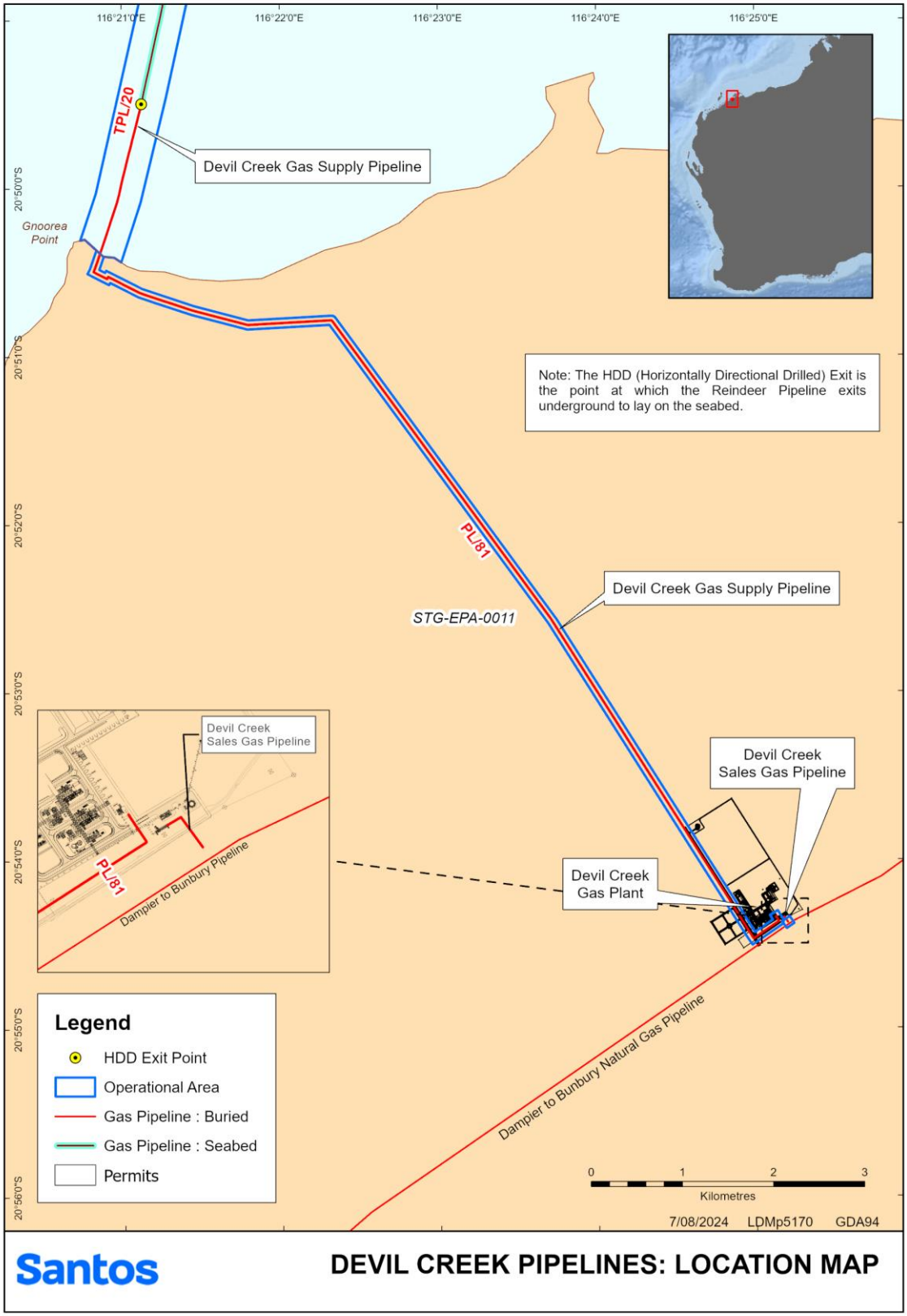


Figure 2-2: Devil Creek supply pipeline and sales gas pipeline onshore

2.2 Activity duration and timing

The DC pipelines operate 24 hours a day, 365 days a year, and all activities including IMMR and preservation campaigns could occur at any time of the year (day or night).

During the operation and CoP phase IMMR campaigns will be undertaken which include, surface and , subsea inspections. Individual general IMMR campaigns are expected to take around 14 days.

The preservation campaigns on the DC pipelines are expected to take approximately 30 days.

Timing and duration of these activities is subject to change due to project schedule requirements, vessel availability, unforeseen circumstances and weather. This EP has risk assessed proposed activities throughout the year (all seasons) to provide operational flexibility.

2.3 Overview of the DC pipelines

Table 2-2: DC Pipelines characteristics

Element	Description
DC supply pipeline design (offshore and onshore)	406.4 mm (16”) nominal bore, has a design capacity of 200 million standard cubic feet per day (MMSCFD). The normal operational flow is 2,800 to 3,100 ksm^3/day (100 to 110 MMSCFD).
DC supply pipeline – offshore section	48.3 km length in State waters seaward from mean low water mark (MLWM) and to the CSB. (approximately 43 km of the DC supply pipeline is in Commonwealth waters (from kilometre point (KP) 91.27 at the Reindeer WHP to KP 48.3 where the DC supply pipeline crosses into State waters)
DC supply pipeline – shoreline crossing	HDD crossing commenced at kilometre point (KP) 2.38 seaward from MLWM.
DC supply pipeline (onshore section)	11.1 km length from MLWM (buried within the 40 Mile Beach Road Reserve adjacent to Mardie Station and Karratha Station pastoral leases.
DC sales gas pipeline	60 m (above and below ground) within the DCGP lease boundary (fenced and out of the scope of this EP as it is part of the major hazard facility (MHF) of the DCGP); a further 40 m underground from the lease boundary through to the DBNGP tie-in, which does form part of the scope of this EP.
DC supply pipeline operations	24 hours a day, 365 days a year (every day)
DC gas production	Maximum flow 6,857 ksm^3/day condensate
Condensate production	Variable depending on flow rate
DCGP commissioning	First sales gas delivered on 21 December 2011
DC supply pipeline	Constructed 2011
DC sales gas pipeline	Constructed 2011
Design life of pipelines	Minimum design life of 20 years
DC pipelines CoP	Anticipated to commence in mid-2025 and extend for a minimum of 36 months

2.3.1 Offshore and onshore DC supply pipeline

In total, the 400 mm (16”) DC supply pipeline (offshore and onshore) between the Reindeer WHP and the DCGP is 102.85 km in length. The offshore pipeline has been horizontally directionally drilled beneath the seabed, 2.38 km seaward of the mean low water mark (MLWM). The remainder of the offshore pipeline sits on the sea floor. The offshore pipeline runs in a southerly direction from the WHP to the mainland, passing from the Commonwealth waters boundary into State waters approximately 48.3 km seaward from the MLWM. The offshore pipeline design was designed with consideration of seabed stability, free spanning, expansion and buckling and corrosion prevention. Concrete coating has also been applied to the length of the pipeline for primary stabilisation. Furthermore, an external anti-corrosion coating has been applied and sacrificial anodes are used to prevent external corrosion.

Landward of the MLWM, the pipeline is designated as an onshore pipeline, located in Pipeline Licence PL81. This onshore section of the pipeline is 11.1 km in length and runs between MLWM to the DCGP. The entire onshore DC supply pipeline is buried underground within the Forty Mile Beach Road Reserve, adjacent to Mardie Station and Karratha Station pastoral leases. The pipeline corridor (i.e. the operational area) is defined as 50 m either side of the pipeline; i.e. a 100 m corridor.

The onshore pipeline corridor was rehabilitated post installation in accordance with MS 795. There is no lighting along the onshore pipeline corridor (along Forty Mile Beach Road).

2.3.2 DC sales gas pipeline

The DC sales gas pipeline links the DCGP to the DBNGP. The pipeline consists of approximately 60 m (with above and below ground sections) within the DCGP lease boundary (fenced) (this is managed under the *DCGP Operations*

EP (DC-40-RI-00021)). A below ground portion of the pipeline extends for 40 m, from the lease boundary through to the DBNGP, terminating at a custody transfer welded tie-in point. The product in-line is dry sales quality gas with no condensate.

2.4 Onshore activities

Activities related to the DC pipelines that will be undertaken throughout operations and CoP phases include the following, with the typical frequency and duration of onshore IMMR activities detailed in Table 2-3:

- Visual Inspection of the pipeline corridor including signage maintenance
- Cathodic protection monitoring and integrity inspections
- Maintenance of pipeline and signage
- Repairs
- Vegetation clearing and excavation if required.

Frequency and duration of these inspections is risk based. Therefore, the details stated in Table 2-3 are indicative and likely subject to change using the MoC process described in Section 8.9.

Table 2-3: Typical frequency and duration of onshore IMMR activities.

Activity	Typical Duration	Typical frequency
Inspection, survey, monitoring		
Pipeline Route and Easement Survey	½ day	6 monthly
Cathodic Protection potential	½ day	Annually
Cathodic Protection close interval potential survey	1 day	5 yearly
Buried coating (direct current voltage gradient) survey	1 day	5 yearly
In-line inspection	1 day	<10 year
Maintenance		
Pipeline marker – Pole maintenance + signage update	1 day	As required.
Repair		
Pipe/coating repair – No work performed to date as the pipeline and the coating are in good condition. If pipe/coating repair is required, it will need section excavation.	Duration will be depending on the scope of the work, estimated to be 1–2 weeks.	As required (following the result of coating survey or in-line inspection).
Non routine excavations and/or vegetation clearing	Duration will be depending on the scope of the work, estimated to be 1–2 weeks.	As required (following the result of coating survey or in-line inspection).

2.4.1 Pipeline route and easement survey

Visual inspections along the pipeline route are carried out during daylight hours to ensure there are no external activities (i.e. road works, service providers or public access) that could impact on the underground pipeline. As per the Onshore Pipeline Inspection Procedure (OP-14-IG-0001) surveillance via ground or aerial pipeline Right of way/Easement are carried out in compliance with Pipelines, Gas and Liquid Petroleum Operation and Maintenance AS-2885.3. Inspection includes the discovery of undetected damage noting indication of leaks such as dead vegetation or evidence of liquid. During inspection activities, vehicles travel along Forty Mile Beach Road Reserve on the public road. Inspections are non-invasive and are focused as specific pipeline inspection points as shown in Plate 2-1 and Plate 2-2 below.

2.4.2 Cathodic protection monitoring and integrity inspections

Pipeline protection monitoring and integrity surveys are undertaken at set locations along the pipeline using designated test points as shown in Plate 2-1 and Plate 2-2 (approximately every 2 kilometres – referred to as kilometre point). At each inspection location, the following activities may be completed:

- Galvanic anode inspection for depletion and security (cathodic protection surveys) (40 m section from DCGP to DBGNP)
- Transformer rectified unit monitoring for impressed current cathodic protection (CP) system for the onshore pipeline
- Close Interval Potential surveys – on-off surveys (CP is switched on and off) are used to evaluate the performance of the cathodic protection, and can be used to detect some coating defects
- Direct current voltage gradient survey – using voltage gradients to investigate the pipeline coating condition
- Weld inspections
- Ultrasonic wall thickness testing.

These are non-invasive inspections – the maintenance team will visit inspection ports along the pipeline (Plate 2-1 and Plate 2-2) – and are typically achieved through handheld devices. For example, cathodic protection is measured using a hand-held cathodic protection probe and wall thickness is tested using a hand-held ultrasonic wall thickness tester.

Plate 2-1: KP2 pipeline inspection location

Plate 2-2: KP0 pipeline inspection location

2.4.3 Maintenance activities

Routine maintenance may include preventative replacement of cathodic protection, spool removal or corrective repair of instruments. Given the operational age of the DC supply pipeline and the fact that the onshore sections of pipelines are underground, there are no routine excavations or high impact maintenance activities planned for the near future, however non-routine excavations may occur if required for unforeseen maintenance activities.

Inspections of the onshore section of the DC sales gas pipeline are scheduled through the computerised maintenance management system (CMMS) and carried out in accordance with routine work orders. Maintenance activities can also be conducted on an as-needed basis, depending on the results of inspections, through corrective work orders (Section 2.5.9).

Onshore external inspection of all Santos subsea assets is based on asset class, as outlined in the Onshore Pipeline Inspection Procedure (OP-14-IG-00002). This procedure covers inspection of onshore pipelines and risers containing hydrocarbons, including all mounted fittings, fixtures and supports.

It is still possible that infrequent maintenance may be required including non-routine excavation and repair of pipeline sections or signage posts. Pipelines repairs may require (re)painting or replacing protective coating, which will require cleaning and preparing the pipeline. This can include ultra-high-pressure water and/or grit blasting with an inert and non-toxic product). This may also include dig up surveys, signage maintenance and replacement.

2.4.4 Vegetation monitoring and management

For construction of the onshore section of the DC supply pipeline, HDD crossing area and DC sales gas pipeline, 21.95 ha of native vegetation was temporarily cleared. In accordance with the conditions of MS 795, rehabilitation of the temporary clearance was undertaken during and immediately after construction in 2010. Regrowth and weed management monitoring of the rehabilitated area commenced in July 2010 under the DCGP Project Operational Rehabilitation Management Plan (DC-40-RI-086).

The OEPA advised in a letter dated 29 February 2016 (OEPA reference AC07-2015-0017) that Conditions 6-1, 6-2 and 6-3 relating to vegetation monitoring and management had been achieved and no further actions were required by Santos. This information was provided to DEMIRS in *the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operational Environment Plan 2015 Annual Performance Report* which was accepted by DMP in a letter dated 29 April 2016 (DMP reference EARS-AER-58211).

Any vegetation clearing will require a new vegetation clearing permit.

2.5 Offshore activities

Inspections of the State waters section of the DC supply pipeline are scheduled through the CMMS and carried out in accordance with routine work orders. Maintenance activities can also be conducted on an as-needed, non-routine, basis through corrective work orders, depending on the results of inspections (Section 2.5.9).

Offshore external inspection of all Santos subsea assets is based on asset class, as outlined in the Subsea Inspection Procedure (SO-35-IS-00001). This procedure covers inspection of all subsea infrastructure, including structural, riser, pipeline, conductor and subsea system assets.

Additional inspections may be performed following physical events (e.g. extreme weather, sea conditions, third-party interactions), integrity assessments or other triggers that indicate further inspection is required. Post-cyclone inspection may include General Visual Inspection (GVI), pipeline, spools and wellhead observation by remotely operated vehicle (ROV) may be able to provide additional surveillance of anomalies or areas of interest flagged by inspections or analysis.

Inspections require a dedicated equipment specific vessel such as a diving support vessel or (ROV) support vessel, or a support vessel equipped with a remotely operated (underwater) towed vehicle (ROTV), autonomous underwater vehicle (AUV) or side scan sonar (SSS) equipment.

2.5.1 Subsea pipeline and seafloor imaging surveys

Subsea, pipeline and seafloor imaging surveys are used to identify:

- Freespans
- Lateral and upheaval buckling
- Severe scour or other seabed disturbance
- Gross variation from as-laid positions
- Debris.

2.5.2 Single-beam echo sounders and multi-beam echo sounder use

Single-beam echo sounders (SBES) use a hydrographic technique that provides the water depths and an image of the seabed and pipeline by measuring the two-way travel time of a high frequency sound pulse emitted by a transducer. The transducer, generally mounted on a vessel or to an AUV, also tracks the motion of the unit it is mounted on in order to allow for correction for the motion. Multi-beam echo sounders (MBES) work in the same way but produce a swath or acoustic fan shaped pulse of sound made up of many single beams. A MBES acquires a wide swath (strip) of bathymetry data perpendicular to the vessel track and provides total seabed coverage with no gaps between vessel tracks.

MBES systems are available for all water depths between 1 m and 12,000 m. The transducer(s) ‘listen’ for the reflected energy from the seabed. The fans of seabed coverage form a series of strips along each track, which are lined up side-by-side to generate two dimensional georeferenced bathymetric maps of the seabed. MBES surveys will enable the collection of bathymetry data and the correlation of depth information. This type of survey uses a sonar system to transmit short pulses of sound energy, analysing the return signal from the seafloor or other objects.

2.5.3 Side scan sonar surveys

SSS is a marine geophysical technique that is used to produce an image of the seafloor and identify obstructions or features. This type of survey is a hydro-acoustic technique, comprising a set of transducers mounted on either side of a towed vehicle, towed approximately 10-20 m above the seabed. SSS transducers may be mounted on AUV systems, vessel hulls or, more commonly, using an ROV.

2.5.4 Sub-bottom profiler use

Sub Bottom Profilers (SBP) utilise an acoustic source typically towed just behind the vessel, with a hydrophone towed approximately 25 m behind the vessel to record the reflected sound waves. SBPs are typically used to understand

physical characteristics of the sea floor (e.g. layering and thickness). Specifically, in relation to the implementation of this EP, sub-bottom profilers may be used to understand the depth of buried pipelines. In these instances, the sub-bottom profilers will report the depth of burial at a transect point along the section of burial and the profile of pipeline burial. The length of each sub-bottom profile inspection is dependent on the length of buried sections of the pipeline and may vary depending on the exact survey or inspection objectives.

2.5.5 Autonomous underwater vehicle use

(AUVs may be used to conduct several geophysical and inspection activities including sub-bottom profiles, MBESs, SBESs, SSS, cameras and conductivity, temperature, and depth (CTD) profilers. It is possible that some IMMR activities could be carried out by an unmanned vessel.

AUVs travel underwater on a predefined ‘flight path’ without requiring navigation from an operator and are fitted with various payloads for data acquisition. The size of the vessel required to deploy an AUV depends on the size of the AUV and the launch and recovery system. An AUV is typically deployed from a vessel using a crane or an A-frame and is recovered using a winch or net.

2.5.6 Remotely operated vehicle surveys

An ROV is typically used to conduct subsea visual inspections. The ROV is tethered to a vessel via an umbilical cable that provides power and control to an operator on the vessel. Thrusters are used to provide propulsion. The ROV is also fitted with a real-time feedback visual monitoring system and lights that provide video relay to the operator on the vessel to allow the operator to subsequently manoeuvre the ROV into position to inspect the pipeline. ROVs can be fitted with a mechanical arm that can also be controlled from the surface to undertake some maintenance activities.

ROVs are usually deployed using an A-frame or winch from a dedicated vessel. ROVs are linked to the vessel by a neutrally buoyant tether or, often when working in rough conditions or in deeper water, a load-carrying umbilical cable is used with a tether management system.

GVI surveys are generally conducted by ROV in some circumstances, divers will be used to conduct GVI and other inspections or works. GVI surveys are used to identify the following:

- Integrity of the pipeline system including all subcomponents
- Location of all features detailed on alignment sheets or as-built records
- Pipeline crossings for pipeline separation and integrity of any support structures and/or stabilisation
- Seabed topography, scour, pipeline settlement and extent of burial
- Freespan lengths, locations, heights and shoulder conditions (shoulders buried, partially buried, resting on seabed)
- Concrete weight coat condition
- Coating condition where visible, and indications of corrosion
- Pipeline protection, stabilisation, scour remediation and span rectification for condition and effectiveness
- Marine growth type and extent
- Debris in contact with or adjacent to the pipeline
- Excessive pipe movements, including expansion effects, and lateral and upheaval buckling
- Other items or anomalies identified following previous inspections.
- GVI surveys are generally conducted by ROV. In some circumstances, divers will be used to conduct GVI and other inspections or works.

Water and sediment sampling may also be undertaken to inform environmental baseline surveys and decommissioning. This may include seabed grab sampling, water sampling and other environmental parameters undertaken by ROV or divers from a vessel.

2.5.7 Environmental monitoring activities

Water and sediment sampling as part of environmental monitoring, may also be undertaken to understand baseline levels. Environmental monitoring activities such as sampling of water, or seabed material (i.e. sediment) or investigation/sampling of biotic material (i.e. marine growth) for environmental studies may be undertaken

2.5.8 Diver surveys

Visual inspection by divers may be undertaken from a dedicated diving support vessel (DSV). Divers are tethered to a vessel via an umbilical, which provides communication, air and a video relay from a camera and lights on the diver's helmet. Divers may also be used for maintenance activities. A Diving Project Plan is developed for each diving program.

2.5.8.1 Cathodic protection surveys

CP surveys are typically carried out concurrently with general visual inspections. CP, such as galvanic anodes and coatings, are applied to the pipeline for corrosion control. The CP survey forms part of the GVI which generally covers the following:

- Galvanic anodes are inspected for depletion and security
- Direct contact cathodic protection potentials of the anodes are taken using a cathodic protection probe
- Continuity strap integrity and effectiveness are tested by measurement of potentials at each end
- Welds are inspected
- Ultrasonic wall thickness is tested
- Coating is removed for inspection access.

CP is measured using an underwater CP probe and/or contactless CP survey method (field gradient method). Ultrasonic wall thickness testing is undertaken using an underwater ultrasonic wall thickness tester. Both are non-destructive test instruments.

2.5.9 Maintenance activities

Maintenance of the State waters section of the DC supply pipeline is managed using the CMMS with consideration given to results from subsea and pipeline inspections. Maintenance activities may include corrective (e.g. repair of equipment) and non-routine maintenance, undertaken in accordance with routine or corrective work orders. Generally, these activities may involve additional personnel and the use of ROVs, divers and work vessels, which may require anchoring at or near the work location. Ongoing operations and maintenance-related activities include:

- Marine growth control
- Corrosion control
- Pipeline route maintenance
- Inline inspections (and cleaning) of the offshore pipeline (pigging)
- Other non-intervention, ad-hoc pipeline repair and maintenance.

2.5.9.1 Marine growth control

As part of ongoing maintenance and to facilitate inspections, marine growth may need to be removed from subsea infrastructure. Marine growth is regularly monitored against design limits. Removal of marine growth is typically only required for inspection purposes and is conducted on localised areas using high-pressure water cleaning or brushing or a combination of methods such as:

- Water jetting – typically conducted by ROVs or divers, where water is pressurised to above hydrostatic pressure. Generally, water-jetting activities shall be through small-diameter water jets that act locally on the DC supply pipeline
- Mechanical brushing – typically a coarse brush is applied to the pipeline
- Vacuuming of infrastructure
- Grit blasting – may be required to expose parent metal on very localised areas only (typically used for spot checks). This activity is conducted via diver intervention. Air and beach sand would be the only components of this type of cleaning technique
- Acid wash removal – on occasion as required by the extent of marine or calciferous growth on subsea infrastructure, small volumes of an acid wash chemical (e.g. citric acid, sulfamic acid, calcium wash) may be used in addition to water jetting, vacuuming or non-aggressive brushing. The acid wash is generally conducted via an acid injection skid mounted on an ROV or lowered to the seabed on a subsea frame

2.5.9.2 Corrosion control

Corrosion control and monitoring activities may involve anode replacements on the pipeline, cathodic protection monitoring, weld inspections, ultrasonic wall thickness testing, free span inspection of the pipeline, coating removal for inspection access, pipeline repair clamp installation, non-destructive testing and general inspections. This work is usually undertaken by ROV, AUV or by divers operating on a DSV, which may also involve the use of additional support vessels.

2.5.9.3 Pipeline route maintenance

Following an inspection as described in Section 2.5, it may be necessary to modify the seabed in the vicinity of a pipeline to correct for free spans (e.g. by placing grout bags under the free span) or burial (by jetting or airlifting sediments from on top of the pipeline).

Where span rectification is required, various methods may be considered. The most common is grout bag installation. An empty grout bag is positioned under the pipeline by ROV or divers and pumped full of a measured volume of grout from the support vessel. Depending on the span height, several bags may be used at a single location to support the pipeline. A field support vessel or DSV is used to support this activity. Where burial is observed, sediments will be jetted or airlifted to displace them from the top of the pipeline.

2.5.9.4 In-line inspection activities

In-line inspection of the pipeline, referred to as pigging, is a routine practice that is undertaken as required, as part of ongoing pipeline integrity management. This practice may involve both the use of intelligent pigs, used for evaluating pipeline integrity and wall thickness, and standard brush and foam pigs, used for operational or corrosion control purposes. Bi-directional cleaning/gauging pigs are used as part of the in-line inspection campaign, prior to sending intelligent pigs.

Pig launchers and receivers are permanently installed at the Reindeer WHP and DCGP to service the DC supply pipeline. Pigs are launched on the Reindeer WHP and received at the DCGP. Disposal of pigging waste is outside the scope of this EP as it is received at the DCGP. Associated risks and impacts are managed in accordance with the DCGP Operations EP (DC-40-RI-00021).

2.6 Safeguards, emergency blowdown and shutdown systems

2.6.1 Safeguards overview

Safeguarding systems are in place and tested to automatically sense any abnormal process or upset condition, to alert the operator or control interface, and to execute actions (such as to isolate process inventories or to initiate shutdown and blowdown equipment).

Safeguarding systems form part of the overall emergency support system installed on a facility and will be used and tested in conjunction with Santos' Health, Safety and Environment Management System. The safeguarding systems are required in an emergency to:

- Provide protection for personnel
- Remove or isolate hydrocarbon inventory
- Prevent damage to equipment, plant and structure
- Minimise the release of hydrocarbons
- Prevent escalation of a single incident to other areas.

The safeguard measures fall into the following general categories:

- Control systems – to maintain operating parameters within prescribed limits
- Process alarms – to alert operators if operating parameters move outside prescribed limits
- Automated emergency shutdown – to isolate sections of the facility to bring it to a safe condition.

2.7 Vessel operations

Dedicated equipment-specific vessels that may be used along the pipeline include DSV, ROV support vessel, or a support vessel equipped with ROTV, AUV or survey equipment. Maintenance activities may typically require one to two support vessels.

Depending on the nature and scale of an activity, a vessel-vessel material or fuel transfer may be needed in rare instances. Therefore, the impacts and risks associated with these activities are included in this EP.

Similarly, anchoring of vessels is not likely to be required for routine activities. However, there are circumstances where anchoring could be required. Therefore, the impact and risks associated with anchoring, including appropriate management controls, are included in this EP.

Support vessels are usually locally based (e.g. Port of Dampier). However, there may be instances where non-local vessels are considered due to availability or task specification requirements. Therefore, the impact and risks associated with sourcing non-local vessels, including appropriate management controls, are included in this EP.

2.8 Preservation activities

Once the DC pipelines reach the end of field life they will need to be cleaned of hydrocarbons and preserved for future decommissioning or re-purposing (Sections 2.10 and 2.11). Flushing with the intent to decommission or repurpose is part of the CoP phase of the activity.

The DC pipelines are expected to be in preservation phase for a minimum of 36 months while decisions are made on whether the facilities will be decommissioned or repurposed. A decision on whether the facilities will be used for CCS or another purpose is expected to be made in the near future

2.8.1 Preservation of DC supply pipeline

2.8.1.1 Flushing to clean and initial preservation

Prior to the preservation, the DC supply pipeline (both onshore and offshore) will be flushed to clean the pipeline and reduce the residual hydrocarbon concentration. The pig receiving equipment will be set up at DCGP and the DCGP evaporation ponds will be prepared to receive the flushing fluids. The pig launching equipment will be set up on the WHP. Pig runs will be performed from WHP the to achieve a residual hydrocarbon concentration of 30 ppm or lower. Preservation chemicals will be injected at the required rates during flushing. Following flushing the DC supply pipeline will be preserved using chemically treated (e.g. with corrosion inhibitors) seawater (~13000 m^3) or an inert gas such as nitrogen.

Once the pipeline has been filled with treated seawater or an inert gas (nitrogen), it will remain in a preserved state until additional preservation is undertaken using nitrogen or treated seawater

2.8.2 Additional preservation

The DC supply pipeline may require additional preservation in the future, to maintain pipeline integrity for repurposing, or, to maintain it for decommissioning. Future preservation may be undertaken using chemically treated seawater or an inert gas such as nitrogen.

2.8.2.1 Nitrogen preservation

If an inert gas such as nitrogen is used, this will be pushed through from the DCGP end of the pipeline. During preservation using nitrogen, the treated seawater that is in the pipeline following flushing during CoP will be discharged from the WHP to the marine environment. The planned discharge to sea from the WHP in Commonwealth waters would be the full contents of the pipeline: 13,000 m^3 of treated seawater.

2.8.2.2 Re-preservation with treated seawater

If the pipeline is required to remain in the preservation phase for more than 3 years, the treated seawater within the pipeline loses its effectiveness and there is the risk of bacterial growth which can affect the integrity of the pipeline. Therefore, the pipeline may be flushed and re-filled with treated seawater again. This can occur from the WHP (either on deck or from a vessel) or from DCGP end of the pipeline.

If this takes place from the WHP, the treated seawater will be discharged to the DCGP. If re-preservation takes place from the DCGP the treated seawater will be discharged from the WHP in Commonwealth waters to the marine environment.

2.8.3 Preservation of DC sales gas pipeline

Hydrocarbons will be removed from the DC sales gas pipeline prior to preservation. This will be achieved by purging with nitrogen which will be pumped into the DC sales gas pipeline from DCGP. Potable water treated with surfactant may also be used to remove hydrocarbons, this will also be pumped in from DCGP and discharged via the evaporation ponds. The pipeline will then be left depressurised for duration of the CoP phase.

2.9 Chemical assessment

A risk-based approach to select chemical products ranked under the OCNS is applied for those chemicals used and discharged to the marine environment. This scheme lists and ranks all chemicals used in the exploration, exploitation, and associated offshore processing of petroleum on the UK Continental Shelf.

Chemicals are ranked according to their calculated hazard quotients by the Chemical Hazard Assessment and Risk Management (CHARM) mathematical model, which uses aquatic toxicity, biodegradation, and bioaccumulation data. The hazard quotient is converted to a colour banding with Gold and Silver colour bands representing the least environmentally hazardous chemicals. 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 with Group E and D representing the least hazard potential.

The Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) accepts CHARM ranked Gold/Silver, or non-CHARM ranked E/D chemicals for use and discharge without a detailed environmental risk assessment. The same applies to chemicals that are OSPAR Pose Little or No Risk to the Environment (PLONOR) List. The PLONOR Listed, agreed upon by the OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic), contains a list of substances that will pose little or no risk to the environment in offshore waters. If chemicals are ranked lower than Gold, Silver, E or D (i.e. CHARM ranked purple, orange, blue or white, or non-CHARM A, B or C ranked chemicals) and no alternatives are available, a risk assessment is conducted providing technical justification for their use and showing their use and associated risk is acceptable and ALARP.

As described above, potential alternative chemicals are investigated when chemicals are ranked lower than CHARM Gold, Silver, E or D (i.e. CHARM ranked purple, orange, blue or white, or non-CHARM A, B or C ranked chemicals). There is a preference for chemical options that are CHARM ranked Gold/Silver, or non-CHARM ranked E/D chemicals and chemicals that have a low aquatic toxicity, are readily biodegradable and do not bioaccumulate (discussed below).

Any chemicals that may be discharged to the marine environment and not OCNS CHARM or non-CHARM ranked are risk assessed using the OCNS CHARM or non-CHARM models. The chemical is assigned a pseudo-ranking based on the available aquatic toxicity, biodegradation, and bioaccumulation data (discussed below) and assessed for environmental acceptability for discharge to the marine environment.

2.9.1 Ecotoxicity assessment

Table 2-4 and Table 2-5 act as guidance in assessing the ecotoxicity of chemicals during the investigation of potential alternatives. Table 2-4 is used by Centre for Environment, Fisheries and Aquaculture UK (Cefas) to group a chemical based on ecotoxicity results, 'A' representing highest toxicity/risk to environment and 'E' lowest. Table 2-5 shows classifications/categories of toxicity against aquatic toxicity results.

Table 2-4: Initial Offshore Chemical Notification Scheme ranking

Initial grouping	A	B	C	D	E
Result for aquatic-toxicity data (ppm)	<1	≥1-10	>10-100	>100-1000	>1000
Result for sediment-toxicity data (ppm)	<10	≥10-100	>100-1000	>1000-10,000	>10,000

Note: Aquatic toxicity refers to the Skeletonema costatum EC50, Acartia tonsa LC50, and Scophthalmus maximus (juvenile turbot) LC50 toxicity tests. Sediment toxicity refers to the Corophium volutator LC50 test.

Source: Cefas Standard Procedure 2019, OCNS 011 NL Protocol PART 1: Core Elements

Table 2-5: Aquatic species toxicity grouping

Category	Species	LC50 and EC50 criteria
Category Acute 1 Hazard statement – Very toxic to aquatic life	Fish	LC_{50} (96hr) of ≤1 mg/L
	Crustacea	EC_{50} (48hr) of ≤1 mg/L
	Algae/other aquatic plant species	ErC_{50} (72 or 96hr) of ≤1 mg/L
Category 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

Category	Species	LC50 and EC50 criteria
Category 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

2.9.2 Biodegradation assessment

The biodegradation of chemicals is assessed using the Cefas biodegradation criteria, which aligns with the categorisation outlined in the United Nations GHS Annex 9 Guidance on Hazards to the Aquatic Environment (2019). The below is used as a guide during the investigation of potential chemical alternatives. Preference is to select readily biodegradable chemicals.

Cefas categorises biodegradation into the following groups:

a. readily biodegradable: results of >X% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol

b. moderately biodegradable: results >20% and <X% to an OSPAR HOCNF accepted ready biodegradation protocol

c. poorly biodegradable: results from OSPAR HOCNF accepted ready biodegradation protocol.

Where X is equal to:

- 60% in 28 days in OECD 306, Marine BODIS 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).

2.9.3 Bioaccumulation assessment

The bioaccumulation of chemicals is assessed using the Cefas bioaccumulation criteria, which aligns with the categorisation outlined in the United Nations GHS Annex 9 Guidance on Hazards to the Aquatic Environment (2019). Preference is to select non bio accumulative chemicals.

The following guidance is used by Cefas:

a. non-bio accumulative/non-bioaccumulating: Log Pow <3, or results from a bioaccumulation test (preferably using Mytilus edulis) demonstrates a satisfactory rate of uptake and depuration, and the molecular mass is ≥700.

b. bio accumulative/Bioaccumulates: Log Pow ≥3, or results from a bioaccumulation test (preferably using Mytilus edulis) demonstrates an unsatisfactory rate of uptake and depuration, and the molecular mass is <700.

All chemicals will be selected in accordance with the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001), as applicable.

2.10 Post Preservation

Santos is currently assessing two re purposing options for the Reindeer facility and DC pipelines,

- reuse of the DC supply pipeline for CCS or
- use of the Reindeer facility and DCGP for processing hydrocarbons from the Corvus field.

2.10.1 Reindeer CCS

The Reindeer CCS project would involve repurposing the DC supply pipeline to transport CO_2 from customers to the Reindeer field, subject to regulatory approvals and customers projects progress.

In support of this project Santos signed a Memorandum of Understanding (MoU) with a proponent to develop a carbon sequestration project for an ammonia facility in the Pilbara near Karratha by re-using Devil Creek and Reindeer facilities to permanently sequester CO_2 in the Reindeer reservoir.

The estimated dates for CCS final investment decision (FID) readiness is 2026 and execution 2029.

2.10.2 Corvus project

Santos is currently in the Concept Select phase for the development of the Corvus field (WA-45-R) located in the Northern Carnarvon basin. Several development concepts are being investigated during this phase, including the option to utilise the DCGP for the onshore processing of hydrocarbons. This option would transport the hydrocarbons from the Corvus field via the DC supply pipeline to the DCGP for processing. The assessment of this as a feasible option is ongoing. The feasibility of this option is subject to ongoing work.

2.10.3 Interrelationship between CCS and decommissioning

Reindeer CCS and the Corvus projects are being assessed as reuse options for the Reindeer facility, DC supply pipeline and DCGP post the preservation phase. Santos is also concurrently planning for decommissioning the Reindeer facility and DC supply pipeline in accordance with the *Policy for Decommissioning of Petroleum and geothermal energy, property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* (DEMIRS, 2024) and the *Decommissioning of petroleum and geothermal energy property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* guideline (DEMIRS, 2024B).

While Santos is assessing repurposing options for the DC supply pipeline and Reindeer facility post preservation, decommissioning is being progressed in parallel as a distinct project.

A summary of proposed timelines, tasks and milestones for planning for decommissioning is provided in Table 2-6 and Table 2-7. The decommissioning timelines also take the timelines for the repurposing options into account.

Table 2-6: Planning for CCS

Timeframes	Tasks and Milestones
2024-2026	Engineering and scientific studies for Reindeer CCS. Development of required approvals, such as a Reindeer CCS EP.
2026	Santos is targeting FID on Reindeer CCS readiness in 2026.
2026 onwards	If the FID is for Reindeer CCS to proceed, and Santos has the necessary regulatory approvals, then the Reindeer CCS project is to be developed.

Table 2-7: Planning for decommissioning

Timeframes	Tasks and Milestones
2026-2027	Engineering and scientific studies for decommissioning (Section 2.11.3)
2025-2028	Assessment of the decommissioning options.
2028-2029	Decommissioning EP to be prepared. Including stakeholder consultation with relevant persons for the decommissioning activities.
2030-2031	If CCS does not proceed, offshore decommissioning execution shall occur (in accordance with an accepted decommissioning environment plan) to meet the requirements of Section 572. The timeframe represents a period in which the task may occur within and may not represent the duration

2.11 Planning for Decommissioning

As outlined in Section 2.11 Santos is planning for the future decommissioning or repurposing of the DC supply pipeline,

Decommissioning is not an activity performed within the scope of this EP, however, is described to provide context for Santos' planning for future phases.

Santos' decommissioning objectives and decommissioning plan are outlined in Sections 2.11.1 and 2.11.2 respectively.

2.11.1 Santos Decommissioning Objectives

Santos' planning for decommissioning includes the following objectives:

- Ensure studies are conducted to understand the potential decommissioning options and environmental risks.

- Improve the maturity of decommissioning knowledge throughout the life cycle of the project.Maintain all structures, equipment and other property in a title area in good condition and repair.
- Ensure the decommissioning plans consider the *Policy for Decommissioning of Petroleum and geothermal energy, property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* (DEMIRS, 2024) and the *Decommissioning of petroleum and geothermal energy property, equipment and infrastructure in Western Australian onshore areas and State coastal waters* guideline (DEMIRS, 2024B).

2.11.2 Santos Decommissioning Plan

Recently Santos has completed significant work on its long term decommissioning plan across Commonwealth and State waters. The decommissioning plan ensures we are carrying out activities at an appropriate time when taking into consideration risk, environmental and safety benefits. This stable long term plan of activity allows for effective resourcing, skills development and financing, allowing for learnings to be applied to ensure the safe and efficient execution of all campaigns.

Santos acknowledges DEMIRS Decommissioning plan and guideline which aims to ensure titleholders have appropriate plans for decommissioning and are completing activities in a timely manner. The proposed schedule is committed to ensuring that all our facilities are in safe condition and do not pose a threat to people, the environment or property, and is aligned with DEMIRS vision of decommissioning being completed in a timely, safe, and environmentally responsible manner.

Santos has split planning for each execution area into three main packages. Noting they may be split into further sub-packages for contracting requirements:

- Package 1: Care and Maintenance including CoP and preservation activities (covered by this EP)
- Package 2: Well Plug and Abandonment (Future Commonwealth waters EP)
- Package 3: WHP and Pipeline Decommissioning (Future EP)

The below schedule summarises the forward plan decommissioning of the DC pipelines and Reindeer facility.

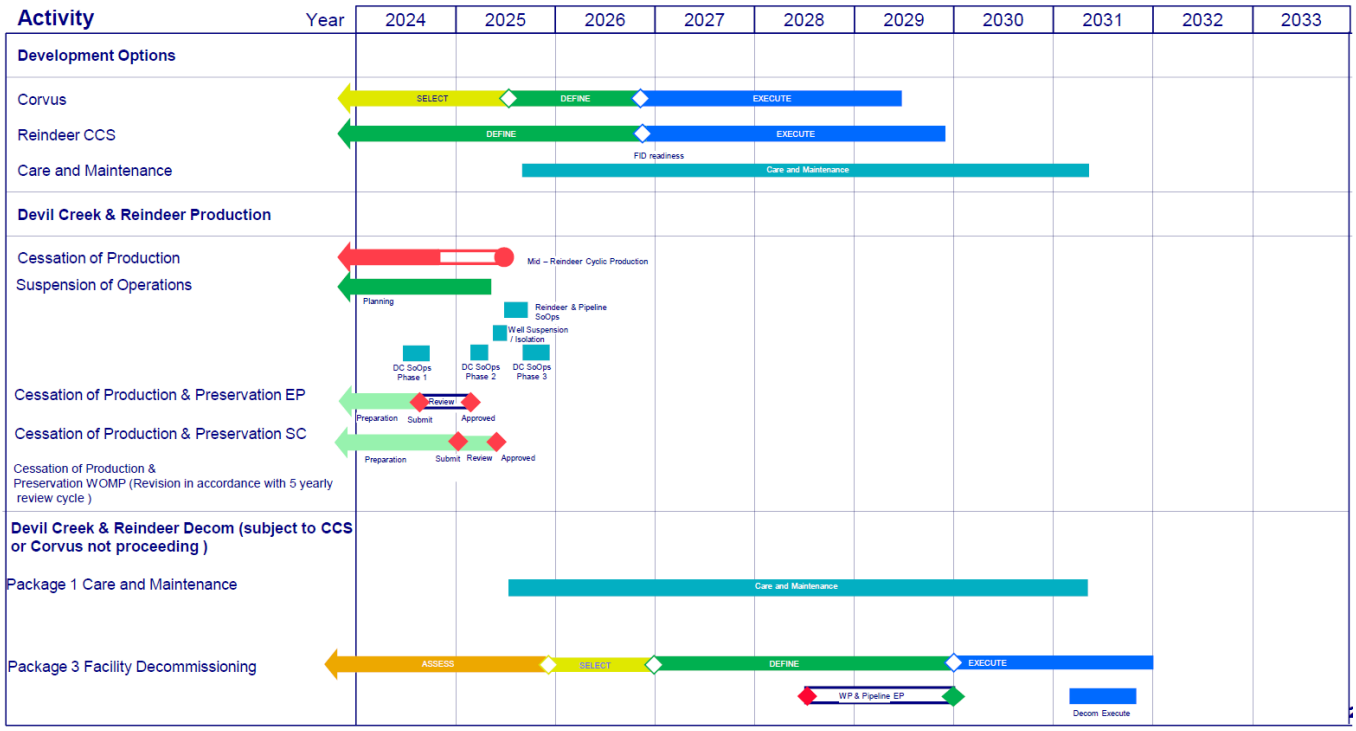


Figure 2-3:Decommissioning plan for DC pipelines and Reindeer facility

Planning for all execution activities starts well in advance of any execution activities. This allows sufficient time for EP submission and approvals and awarding of key contracts post EP approval and package Final Investment Decisions (FID).

The environmental approvals associated with the decommissioning packages are outlined below:

Package 1: Care and maintenance.

Care and maintenance is addressed in this EP. It includes CoP and preservation activities'

Package 2: Well Plug and Abandonment (future EP): The wells are associated with the Reindeer Field and WHP is in Commonwealth waters which is outside DEMIRS approval jurisdiction**.**

Package 3 WHP and pipeline decommissioning

A pipeline decommissioning EP will be submitted to DEMIRS which addresses the following:

- detailed plans of the proposed subsea decommissioning activities. In particular, the fate of all property on the title, proposed decommissioning methodology, scope of work and execution strategy
- Santos acknowledges that where a decision to pursue a deviation to the base case of full removal is proposed, the EP must demonstrate that a deviation delivers equal or better environmental outcomes compared to complete property removal
- an evaluation of the feasibility of all options, including partial and complete property removal
- an evaluation of environmental impacts and risks of all feasible options, including complete property removal. The evaluation of all the environmental impacts and risks of each option must include consideration of control measures necessary to manage the impacts and risks
- evaluation of all environmental impacts and risks within Australia's environment including, where relevant, indirect consequences that may arise from the petroleum activity of removing property from a title area
- where deviation/s to removal of property or relocation of property is proposed, Santos will address arrangements for monitoring and management

2.11.3 Studies

Various technical and environmental studies may be undertaken to support decommissioning as outlined in Table 2-8.

Table 2-8: Studies proposed to support decommissioning

Decommissioning option	Study	Timing	Scope / Purpose
Removal and leave in situ	Technical feasibility assessment	2026-2028	Assessment of technical feasibility of infrastructure removal
	Comparative assessment of decommissioning options	2026-2028	Comparison of technically feasible decommissioning options against environmental and social assessment criteria
	Waste management study	2026-2028	Identify options for repurposing, recycling and disposal of materials
	Environmental Sampling	2026-2028	Environmental sampling to inform impact and risk evaluation for future activities
Leave in situ only	Degradation assessment	2026-2028	Material degradation assessment (concrete, plastic, steel etc.) for leave in situ option
	Snag risk assessment	2026-2028	Assessment of snag risk associated with leaving infrastructure in situ
	Biodiversity & habitats assessment	2026-2028	Assessment of biodiversity associated with infrastructure

2.11.4 Maintaining Property to Enable Decommissioning

The DEMIRS decommissioning guidelines (DEMIRS, 2024) outline provision must be made for the maintenance of property, equipment and infrastructure that allows for full removal or future reuse.

During both the Operation and CoP phases, Santos will ensure through IMMR and integrity management activities (as described in Section 2.4 and 2.5) that all property is maintained in a state that ensures it can be removed safely at the end of its life, or an alternate end state agreed.

3. Description of the environment

P(SL)(E)R 2012
Regulation 14(2)
The environment plan must a. describe the existing environment that may be affected by the petroleum activity b. include details of the particular relevant values and sensitivities (if any) of that environment.

3.1 Environment that may be affected (EMBA)

This section provides a summary of the existing environment that may be affected by the planned and unplanned activities covered in this EP, and includes details on the particular relevant values and sensitivities of that environment. The description of the environment applies to two areas:

- The operational area, which includes The DC pipelines onshore and offshore in Western Australian State jurisdiction within which planned activities will occur
- The environment that may be affected (EMBA), shown in Figure 3-1.

A detailed and comprehensive description of the environment (required by P(SL)(E)R 2012, Section 14 (2) in the operational area and EMBA is provided in this section and within Appendix C. Copies of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) outputs for the operational area and the EMBA are also available in Appendix D.

The EMBA encompasses the environment that may be affected by planned and unplanned events. The impacts and risks from planned events associated with the activity may affect the environment up to a few tens of kilometres from the operational area e.g. from light impacts (as identified in Section 6). A large unplanned hydrocarbon spill would extend substantially beyond this (Section 7).

3.1.1 Determining the offshore EMBA

Stochastic hydrocarbon dispersion and fate modelling, applied to the worst-case spill scenario identified as relevant to the activity (Section 7), was undertaken to inform the EMBA. Stochastic modelling is created by overlaying 150–300 individual hypothetical oil spill simulations from an oil spill into a single map, with each simulation subject to a different set of metocean conditions drawn from historical records. Stochastic modelling is completed to reduce uncertainty in risk assessment and spill response planning may not represent the actual path that an actual spill could take.

To ensure a representative EMBA was correctly assessed in this EP, the EMBA for all of the modelled worst-case scenarios (e.g. subsea pipeline rupture and vessel collision) were combined to create a single EMBA representing the greatest spatial extent.

The modelling considered four key physical or chemical phases of hydrocarbons that pose differing environmental and socioeconomic risks: surface, entrained, dissolved aromatic and shoreline accumulated hydrocarbons. The modelling used defined hydrocarbon exposure values for each hydrocarbon phase, as relevant, to identify an area that might be contacted by hydrocarbons, and to inform the environment risk assessment and oil spill response planning. The three exposure values used were.

- the low exposure values to define the EMBA
- the moderate exposure values to define the moderate exposure value area (MEVA)
- the high exposure values to define the high exposure value area (HEVA).

The EMBA is based on stochastic modelling, using the low exposure values (Table 3-1). The EMBA encompasses the outer most boundary of the overlaid worst-case spatial extent of the four hydrocarbon phases listed above for the worst case credible spill scenario and as such, encompasses the full range of environmental receptors that might be contacted by hydrocarbons in the highly unlikely event of a worst-case hydrocarbon spill.

The low exposure values used to set the outer boundaries of the EMBA are not expected to result in ecological impacts. The low exposure value for surface hydrocarbons represents a visible oil (rainbow) sheen and has been used to provide an indication of the extent to which other marine users may visually observe oil on the sea surface. This is considered to provide a conservative extent of potential impacts to other marine users. Biological impacts may occur within the moderate exposure value area (MEVA) and high exposure value area (HEVA), both of which represent a subset of the EMBA. Consequently, the evaluation of potential environmental consequences of a

hydrocarbon release (impact assessment) were based on the MEVA and HEVA. Refer to Section 7.6.5 for further information on the spill trajectory modelling thresholds that have been selected.

Refer to Table 3-1 for the exposure values used and to Sections 7.6 to 7.9 for further information on the reasons why these exposure values have been selected and how they relate to the risk assessment. These three exposure values are shown in Figure 3-1.

Table 3-1: Hydrocarbon exposure values

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)	1000	1000	-

3.1.1.1 Modelling locations

The worst-case discharge from the worst case pipeline rupture scenario has been modelled at the Commonwealth-State waters boundary (CSB) and the HDD crossing as this is the closest point of the operational area to any environmental sensitivities. The worst-case marine diesel oil (MDO) discharge from a vessel collision scenario was modelled at both the CSB and HDD crossing. The co-ordinates of these locations are provided in Table 3-2

Table 3-2:Spill modelling locations

Scenario No.*	Description	Latitude	Longitude
2	121.4 m^3 release of condensate over 3.71 hours following a subsea pipeline leak near the CSB	20° 24’ 39.44” S	116° 20’ 08.56” E
3	121.4 m^3 release of condensate over 3.75 hours following a subsea pipeline leak at the HDD break through location (or shoreline crossing)	20° 49’ 29.89”S	116° 21’ 07.52”E
5	325 m^3 surface release of MDO over 1 hour following a vessel collision at the CSB	20° 24’ 20.40” S	116° 20’ 08.60”E
6	325 m^3 surface release of MDO over 1 hour following a vessel collision at the HDD break through location (or shoreline crossing)	20° 49’ 07.60” S	116° 21’ 12.70”E

**Note: Scenarios 1 and 4 are locations in Commonwealth waters and are therefore not described in this EP.*

To ensure a representative EMBA was correctly assessed in this EP, the EMBA for all of the modelled scenarios (pipeline rupture and vessel collision) were combined to show the greatest extent of a potential spill with the area and create one defined EMBA (Figure 3-1).

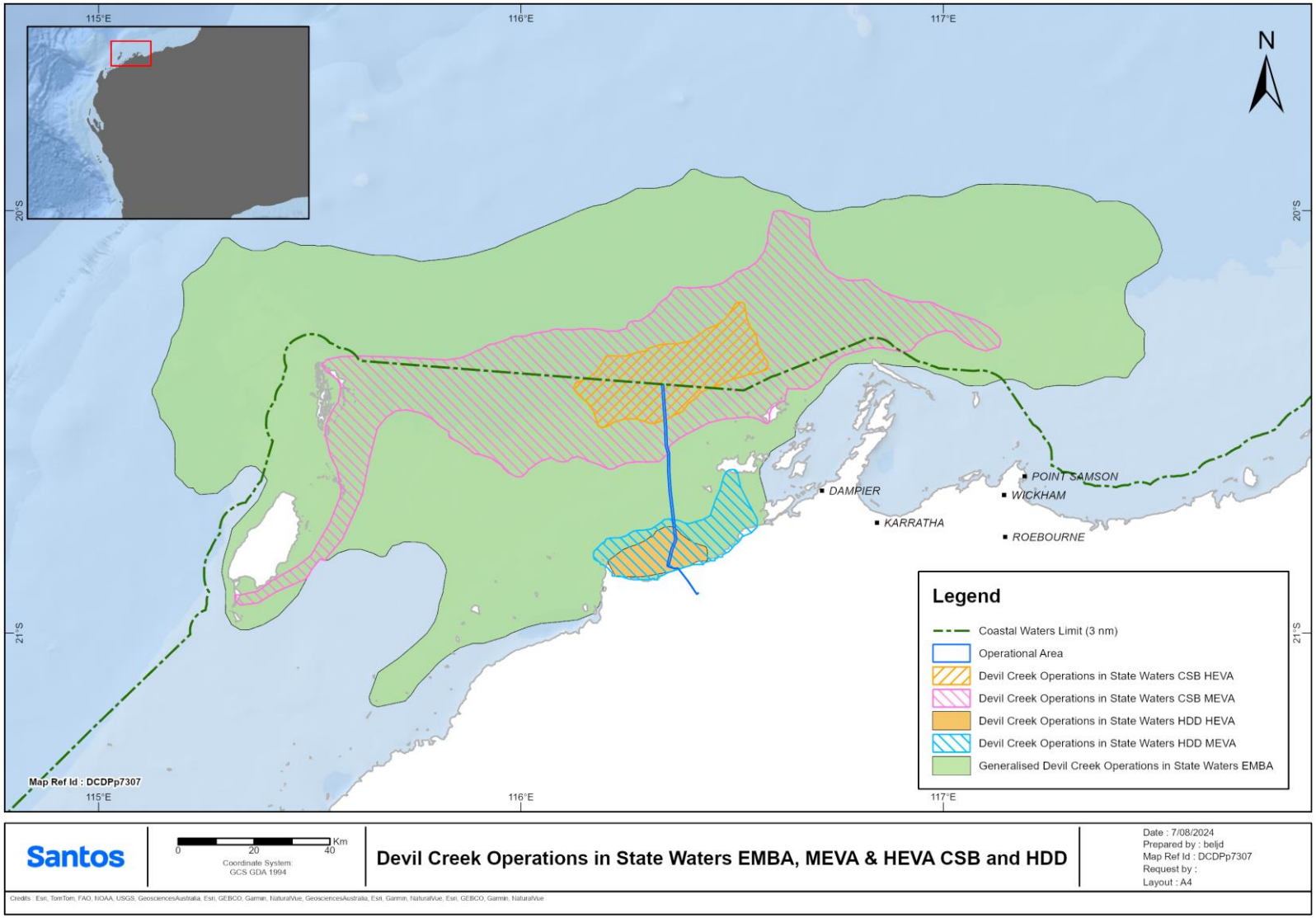


Figure 3-1: HEVA and MEVA at Commonwealth State Boundary (CSB) and the horizontal directionally drilled (HDD) crossing and worst-case EMBA for Devil Creek pipelines

3.1.2 Determination of onshore EMBA

The onshore EMBA is an area defined by assessing the risk of a loss of containment of the onshore section of the DC supply pipeline. The onshore maximum credible spill scenarios, impacts and controls are defined within Section 7.9.

The onshore section of the DC supply pipeline is below ground. It is unlikely that there will be any surface expression of hydrocarbons given the relatively low rate of condensate flowing, hydrocarbon characteristics, and porosity of the sediments. There are some low-lying sections of the pipeline through mudflats at the shoreline end of the onshore DC supply pipeline and on the onshore section of the HDD crossing.

The groundwater dissolved contaminant plume extent is estimated to have the potential to move up to 200 m from leak/rupture point to either side of the pipeline within a year and this is under conservative conditions. This zone of potential impact was derived based on the modelled estimates provided in a detailed general pipeline spill assessment Further detail on the groundwater system is provided in Section 3.2.4.1

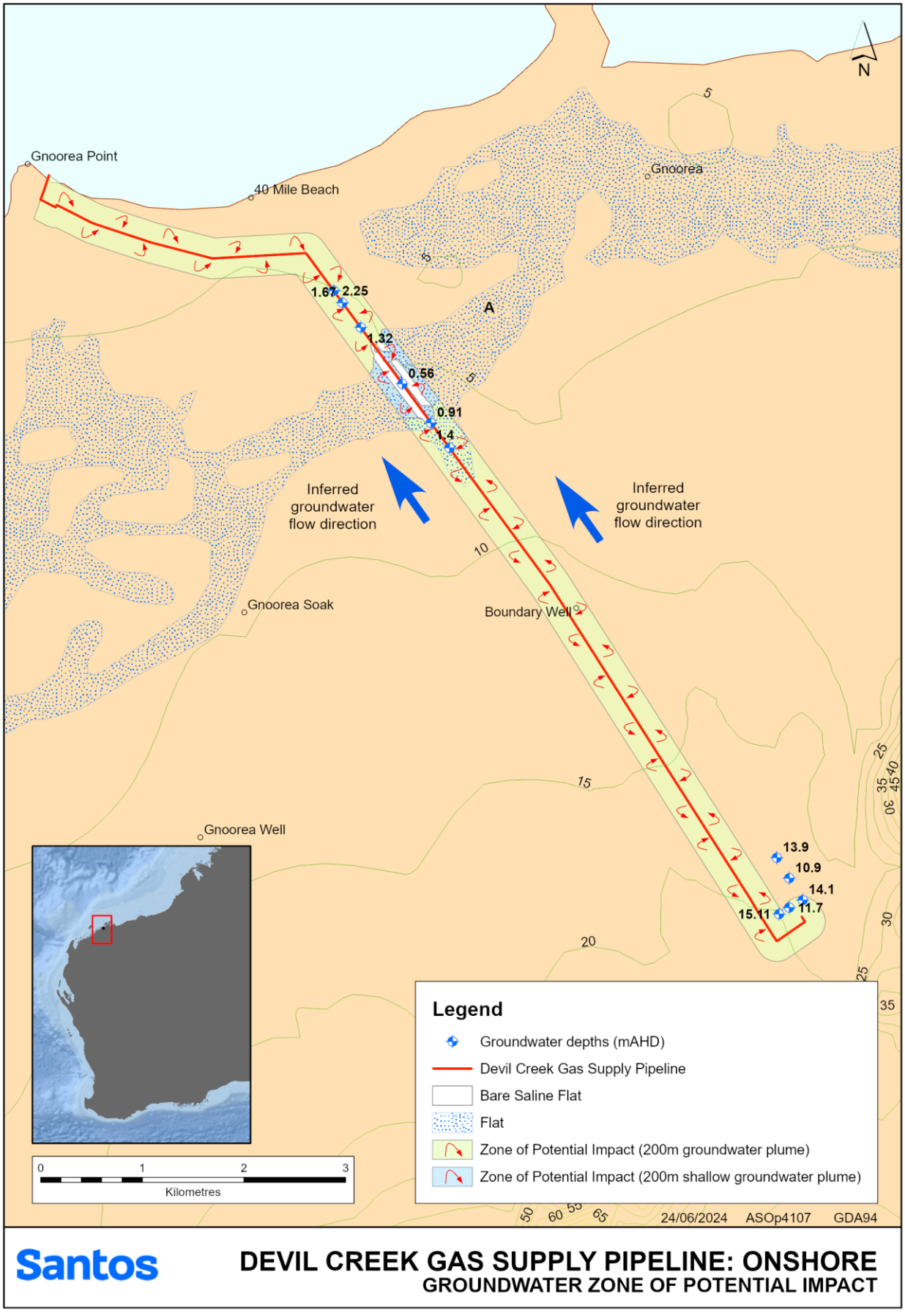


Figure 3-2: Devil Creek supply pipeline and sales gas pipeline zone of potential impact

3.2 Environmental values and sensitivities

This section summarises environmental values and sensitivities, including physical, biological, socio-economic and cultural features in the marine, coastal and onshore environment that are relevant to the operational area and the EMBA.

A comprehensive description of the environmental values and sensitivities of the existing environment within the EMBA (as required by regulation 14(2) of the P(SL)(E)R), specific to the EMBA for this EP is provided in Appendix C. It is a compilation of environmental values and sensitivities including physical, biological, social, economic and cultural features within the marine and coastal environment that are relevant to this activity.

PMST searches were undertaken in April 2025 on the operational area, the MEVA, the HEVA, and the EMBA. The PMST searches were completed using the exact co-ordinates that are used to produce the figures throughout Section 3, ensuring the EMBA encompasses the full range of environmental receptors that might be contacted by surface and subsurface hydrocarbons at the low exposure level, in the highly unlikely event of a worst-case oil spill.

A summary of the information derived from the Protected Matters Search, Bioregional Plans and the identified fauna Recovery Plans of relevance to the operational area, the MEVA and the EMBA is provided in this section.

Distances to sensitive receptors have been measured to the border of the operational area.

3.2.1 Operational Area metocean conditions

A detailed oil spill modelling study which assessed the risk and potential exposure to the surrounding waters was commissioned by Santos and undertaken by RPS (RPS 2024). An extensive selection of physical environment properties was used as inputs in a three- dimensional oil spill model to simulate the drift, spread, weathering and fate of the spilled oil. A summary is provided below and more details can be found in *Santos Reindeer Hydrocarbon Spill Modelling Report* (RPS 2024).

3.2.1.1 Currents

The area of interest for this study is typified by strong tidal flows over the shallower regions, particularly along the inshore region of the Northwest Shelf and among the island groups stretching from the Dampier Archipelago to the Northwest Cape (Figure 3-3). However, the offshore regions with water depths exceeding 100–200 m experience significant large-scale drift currents. These drift currents can be relatively strong (1–2 knots) and complex, manifesting as a series of eddies, meandering currents, and connecting flows. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals) and thus will have greater influence upon the net trajectory of slicks over time scales exceeding a few hours.

Wind shear on the water surface also generates local-scale currents that can persist for extended periods (hours to days) and result in long trajectories. The tidal currents are generally weaker in the deeper waters, their influence is greatest along the near shore, coastal passage regions and, in and around islands.

At the WHP, the average and maximum surface current speeds were 0.30 m/s and 2.51 m/s, respectively. The general annual current directions were tidally dominated and flow along the southeast – northwest axis.

The average and maximum surface current speeds at the CSB were 0.23 m/s and 1.35 m/s, respectively, with variable current directions.

Adjacent to the HDD crossing, the average and maximum surface current speeds were 0.14 m/s and 0.61 m/s, respectively. The current directions were tidally dominated, flowing along the southeast – northwest axis.

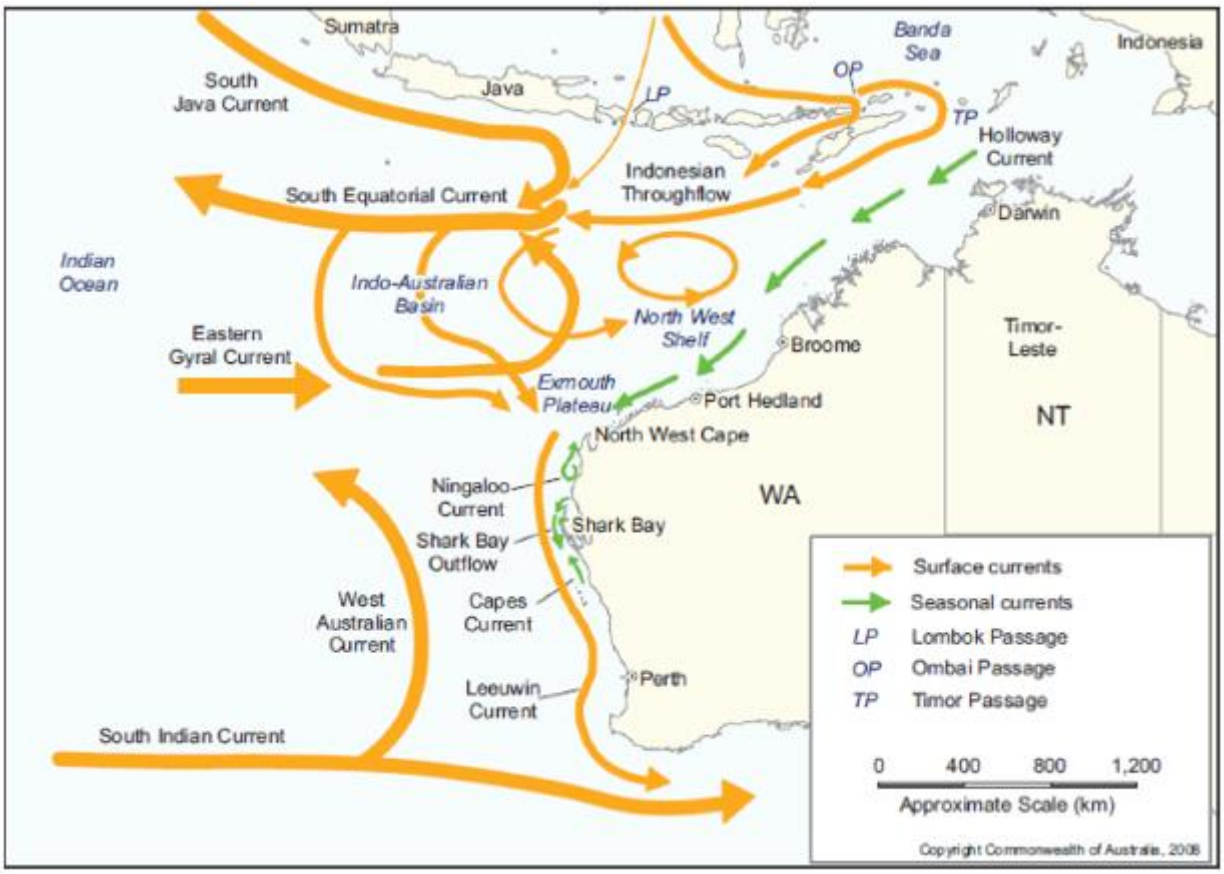


Figure 3-3: Schematic of ocean currents along the north-west Australian continental shelf

Source: Image adapted from DEWHA (2008).

3.2.1.2 Wind

To account for the influence of the wind on the floating oil, wind data from 2010 to 2019 (inclusive) were sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR; see Saha et al., 2010). The CFSR wind model includes observations from many data sources; surface observations, upper-atmosphere air balloon observations, aircraft observations and satellite observations.

The region experiences predominantly moderate winds throughout the year, with average and maximum wind speeds ranging from 11.7–52.3 knots, respectively. In the summer months (October to March), the prevailing winds are from the west. Conversely, during winter (May to August), the winds predominantly originate from the east-southeast and tend to be notably stronger. Transitional months exhibit a more variable wind directionality.

3.2.1.3 Water temperature and salinity

The monthly depth-varying water temperature and salinity profiles adjacent to the WHP, CSB and HDD crossing release locations were obtained from the World Ocean Atlas 2018 database produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) and its co-located World Data Center for Oceanography (Levitus et al., 2013). The data was used by RPS in their modelling to inform the weathering, movement and evaporative loss of hydrocarbon spills in the surface and subsurface layers.

Table 3-3 shows that the monthly average sea surface (up to 5 m depth) temperatures and salinity adjacent to the release locations. Surface temperatures were similar at all three locations ranging from 24.4 °C (August to October; nearby the HDD crossing) to 29.3 °C (March; nearby the WHP). Salinity remained consistent throughout the year ranging between 34.6 ppt (November; nearby the HDD crossing) and 35.6 ppt (May; nearby the HDD crossing).

Table 3-3: Monthly average sea surface temperature and salinity in the 0–5 m depth layer adjacent to the CSB and HDD Crossing release locations

Location	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
CSB	Temperature (°C)	27.1	28.4	29.1	28.3	27.3	25.8	25.2	24.5	24.6	24.9	26.7	26.8
	Salinity (psu)	35.4	35.3	35.4	35.5	35.5	35.3	35.1	35.0	35.2	35.0	34.6	35.2

Location	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
HDD Crossing	Temperature (°C)	27.1	28.4	29.0	28.2	27.3	25.8	25.0	24.4	24.4	24.4	26.7	26.8
	Salinity (psu)	35.4	35.4	35.5	35.5	35.6	35.4	35.2	35.1	35.3	35.1	34.6	35.3

3.2.2 Bioregions

The operational area and the EMBA associated with operating the State waters section of the DC supply pipeline is located in the Barrow Sub-basin on the Northwest Shelf Province in the North-west Marine Region (DEWHA, 2008), in water depths of 0 to approximately 38 m at lowest astronomical tide.

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA), Version 4.0 (Department of Environment and Heritage, 2006), the bioregion overlapped by the operational area and EMBA is the Northwest Shelf Province.

Onshore on a regional level, the DCGP area falls within the Littoral, Cheerawarra and Horseflat land systems (Van Vreeswyk *et al.,* 2004). The broader surrounds include coastal dunes, a sandy coastal plain, a semi-saline inlet and associated sandy islands, weakly gilgaied and non-gilgaied plains, and low hill slopes.

The DCGP onshore area falls within the West Pilbara Granite-Greenstone Terrane and is overlain by more recent alluvial deposits, coastal sand and dune deposits, with coastal limestone, beach conglomerate and occasional granite outcrops.

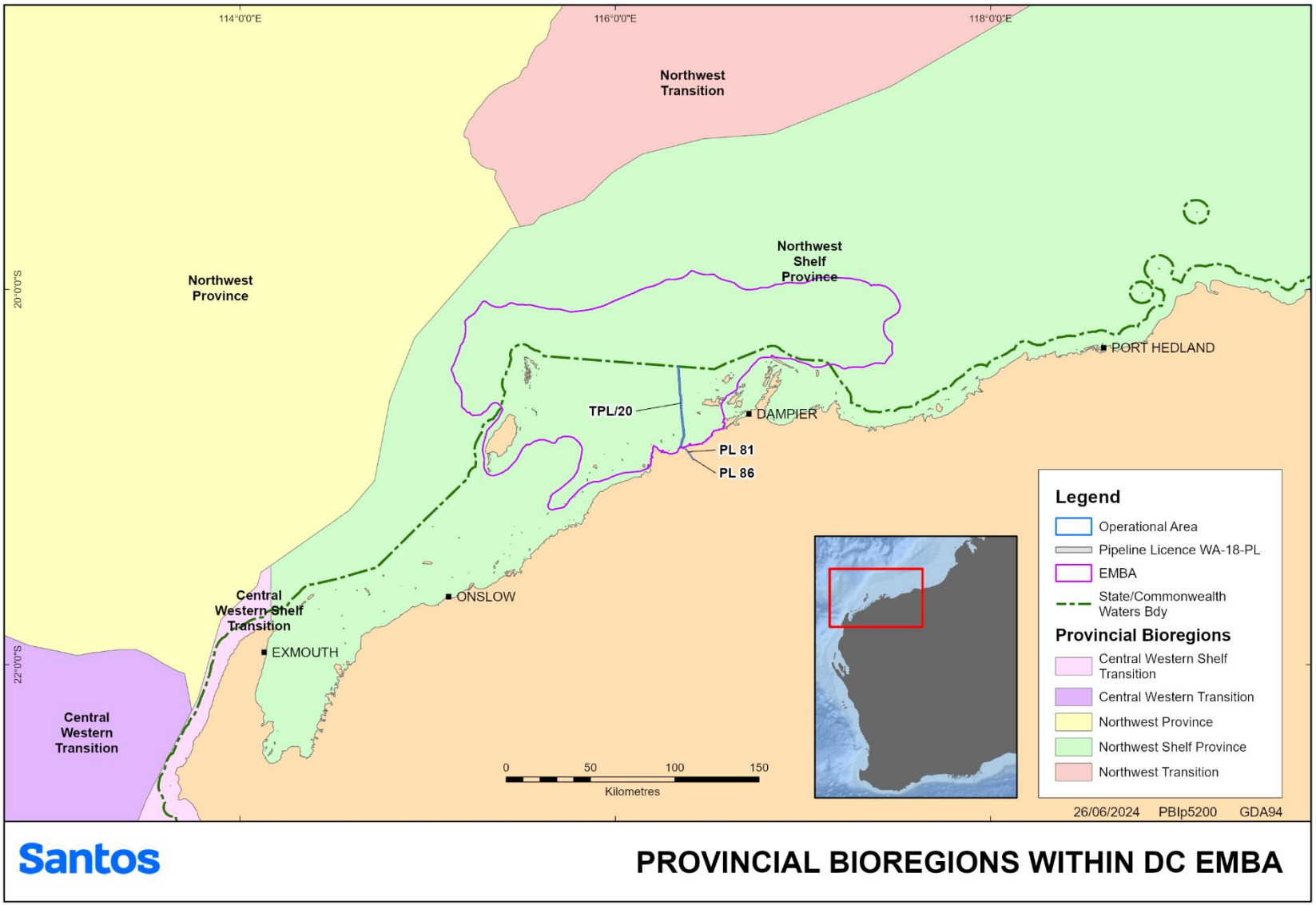


Figure 3-4: Offshore provincial bioregions

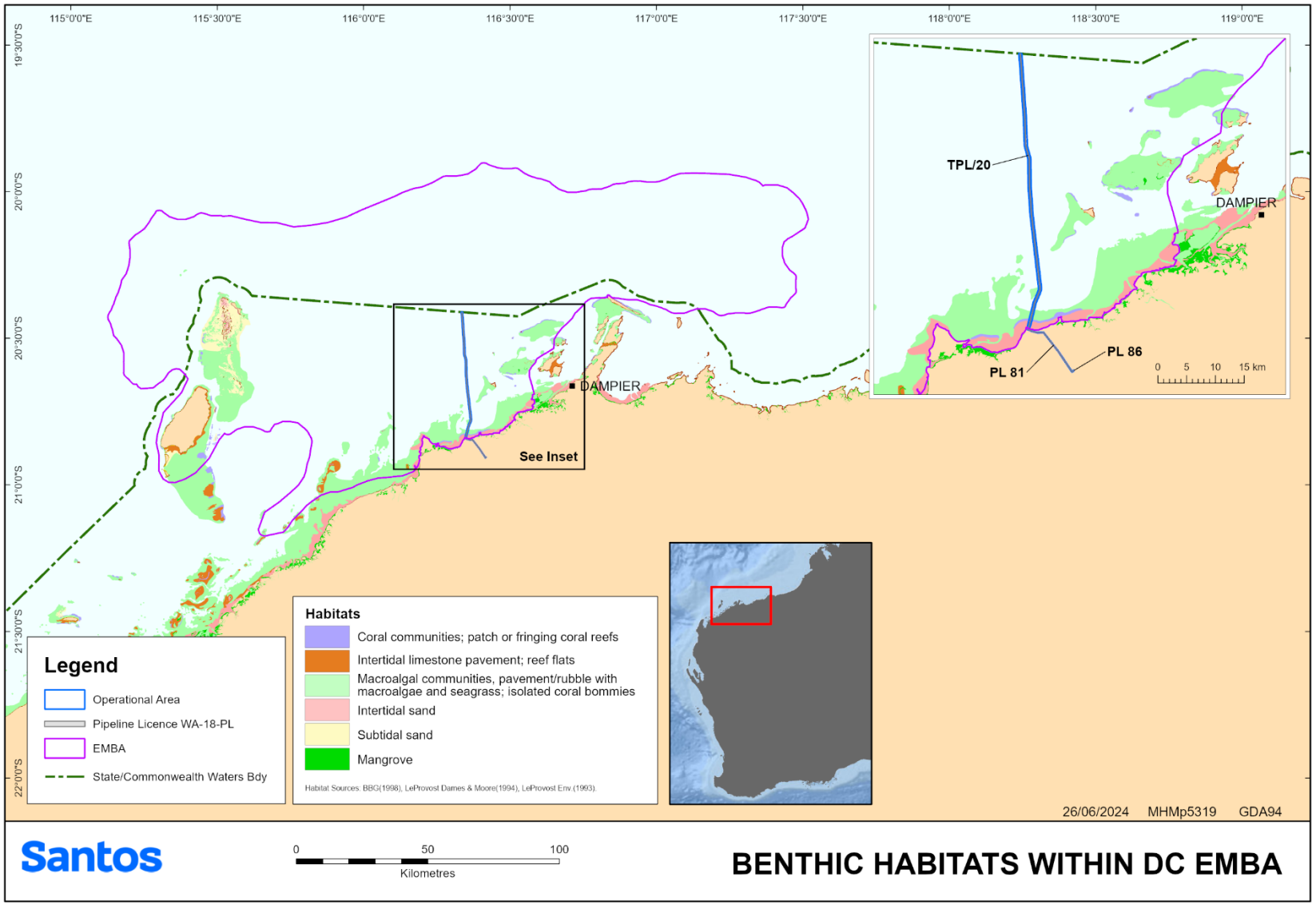


Figure 3-5: Nearshore, subtidal, intertidal and shoreline habitats in the vicinity of the offshore DC supply pipeline

3.2.3 Benthic habitats

A detailed marine survey of the seabed along the pipeline alignment was carried out in October 2007 (RPS, 2008). A range of benthic habitat and associated communities were encountered, the composition of which appeared to vary according to substrate-type, depth and prevailing currents.

The presence of marine, coastal and terrestrial habitats within the operational area and EMBA are shown in Figure 3-5. The presence of marine and coastal habitats within the operational area and EMBA is summarised in Table 3-4 and a detailed description of these habitats with reference to the IMCRA provincial bioregions is provided in Values and Sensitivities of the Western Australian Marine Environment (EA-00-RI-10062, Appendix C).

Operational Area

Unconsolidated sediments support diverse benthic fauna living both in the sediments (infauna) and on the surface (epifauna) as well as flora such as seagrasses. Infauna species found in soft sediments consist predominantly of mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Surface-dwelling soft sediment species include small crustaceans and molluscs, asteroids, echinoids and larger sessile organisms such as sponges, corals, sea whips and sea squirts (DEC, 2007).

Soft sediment habitats that support infauna are widespread both offshore and in more protected inshore environments throughout the region, while complex epifaunal assemblages typically occur inshore (CALM & MPRA, 2005; CALM, 2005; DEC, 2007; DEWHA, 2008).

The benthic survey undertaken by RPS (2008) identified that the zone between 2 and 10 km offshore was a mixture of bare sand patches with medium-to-coarse grains, and exposed pavement with sand veneers (Figure 3-5). The bare sand areas supported medium-to-dense patches of heart urchins and areas of minor bioturbation. The dominant substrate from 15 to 20 km offshore was bare coarse sand of unknown depth. Between 29 and 33 km offshore, rock and coral bomboras (Figure 3-5) were identified, surrounded by exposed rock pavement, with sand veneers and areas of bare sand supporting the growth of low-to-medium density seagrass (Figure 3-5) (*Halophila*), *Caulerpa* and *foraminiferans* (RPS, 2008).

Bare bioturbated (mixed) sands extended further offshore along the pipeline route and were the dominant feature between 33 and 44 km offshore. Very occasionally, crinoids and hydroids were observed, with occasional macroalgae in the shallower water. Between 50 to 51 km offshore, rock pavements extend into areas previously described as medium-to-coarse and coarse gravelly sands, characterised by occasional sponges, crinoids, hydroids, sea whips, ascidians, isolated patches of gorgonian fans, very occasional sea stars and bare bioturbated sands.

Submerged habitats of the inner to mid-shelf environments of the North West Shelf (NWS) include hard substrate habitats. Submerged hard substrate habitats include pavement and high relief reef areas that provide attachment points for sessile epifauna as well as perches and hiding places for mobile epifauna. The abundance and diversity of epifauna observed in these habitats markedly exceeds that found in soft sediment areas where many of the mobile species are hidden beneath the sediment.

Hard substrate habitats provide suitable surfaces for the attachment of sessile invertebrates including ascidians, bryozoans and hydroids, as well as mobile epifauna such as crinoids use these structures to raise them above the sediment to filter feed. In addition to epifauna, macroalgae are an important component of this submerged habitat type.

RPS (2008) identified hard pavement areas between 2 and 10 km offshore (Figure 3-5). The pavement areas had minor to moderate macroalgal cover including *Dictyopteris, Asparagopsis* and occasional patches of *Padina* and *Udotea*, as well as small corals, gorgonians and occasional sponges. The number of coral species and coral cover increased slightly as the depth decreased towards the shore, along with the occurrence of isolated coral bomboras and coral patch reefs.

Between 10 and 15 km offshore, rock pavement with sand veneers was again the dominant feature, the pavement supporting the growth of macroalgae (mostly *Asparagopsis* and *Dictyopteris*), minor sponges, sea whips, gorgonians, and occasional crinoids, ascidians and corals, including *Turbinaria* and *Porites*.

A low-profile rock pavement ridge was identified running approximately east-west between 21 and 23 km offshore. This ridge area was characterised by exposed limestone rock pavement dominated by macroalgae, with sponges, corals and gorgonians. The corals included *Porites* and *Turbinaria*. Small numbers of ascidians and sea whips were also present. An additional area containing coral bomboras up to 1.5 m high was identified to the east of the corridor centreline between 20 and 22 km offshore. The dominant feature at this site was the surrounding rock pavement with sand veneers, macroalgae and minor small corals including *Acropora, Turbinaria* and *Porites*.

Multiple large rock and coral bomboras (isolated reef structures), surrounded by exposed rock pavement with sand veneers and areas of bare sand, were identified between 29 and 33 km offshore, mainly to the west of the centreline of the pipeline corridor. The coral bomboras ranged in height from 1 m to 6 m and were dominated by large plating

Pachyseris species. Dense schooling reef fish and pelagic (found in open water) fish were associated with areas of high coral cover.

Rock pavement areas surrounding the coral bomboras support medium-to-high density sponges and macroalgae, including the algae *Dictyopteris.* Bare sand areas support the growth of low-to-medium density seagrass (*Halophila*), *Caulerpa* and *foraminiferans*.

Similar to nearby fringing reefs that comprise a mixture of massive coral colonies often dominated by *Porites* and *Acropora*, 1–6 m coral bomboras were identified 29–33 km offshore, dominated by large plating *Pachyseris* species. Dense schooling reef fish and pelagic fish were associated with areas of high coral cover (RPS, 2008).

Macroalgae were found in patches between 10 and 22 km offshore along the pipeline route (RPS, 2008) (Figure 3-5).

A small amount of seagrass is known to occur in the vicinity of the offshore pipeline route, between 29 and 33 km offshore (RPS, 2008) (Figure 3-5).

Plate 3-1: Plating *Pachyseris* on large coral bombora

Plate 3-2: Sandy pavement with *Asparagopsis* and sponges

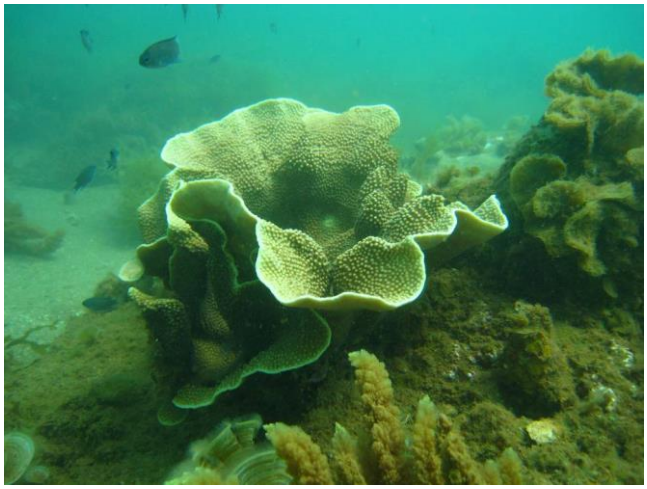


Plate 3-3: Patch coral reef with macroalgae

Plate 3-4: Medium-to-high density seagrass meadow

EMBA

Corals are significant benthic primary producers that play a key role in the ecosystem of many reef environments and have an iconic status in the environments in which they occur. Corals are invertebrates of the class Anthozoa (*Phylum Cnidaria),* typically forming colonies of individual polyps. They contain photosynthetic unicellular algae called zooxanthellae and are reliant on sunlight. Corals can be grouped into the following categories:

- Scleractinian corals (hard corals): reef building corals
- Non-scleractinian corals (sometimes referred to as calcified soft corals): generally not considered to be reef building
- Soft corals belonging to the order Alcyconacea: non-reef building.

Coral reef communities of the NWS are in shallow waters (typically less than 30 m), primarily in areas with clear water and strong currents. Coral reefs provide essential habitat for fish, crustaceans, sponges and molluscs (Spalding et al., 2001). As stated above, the corals supported by hard substrates found in the offshore pipeline corridor consist of *Acropora, Turbinaria* and *Porites*.

Significant coral spawning occurs in autumn (March and April), although some taxa such as *Acropora* spp. spawn in spring (October and November) and summer (Rosser & Gilmour, 2008).

Macroalgae are most prolific over shallow areas of the region (less than 25 m) where sufficient light is available for photosynthesis, particularly where hard substrates occur on which they attach. Sargassum is the most abundant, but other important taxa include *Halimeda, Caulerpa, Dictyopterus, Dictyota, Cystoseira, Padina, Codium* and *Laurencia*. *Caulerpa* is one of the few macroalgae that attach to soft sediments and often grows in association with *Halophila* seagrass meadows.

Macroalgae are important primary producers and support diverse and abundant fauna of small invertebrates that are the principal food source for many inshore fish species.

Macroalgae are the dominant macrophyte in the shallow waters surrounding the numerous islands along the Pilbara coast, from the Exmouth Gulf to the Dampier Archipelago (CALM, 2005; DEC, 2007). Seagrasses

Seagrasses are important primary producers in tropical inshore waters as they provide energy and nutrients for detrital grazing food webs. They are also directly grazed by protected animals such as dugongs and green turtles, and provide refuge areas for fishes and invertebrates (DEC, 2007).

Seagrasses usually grow on mud, sand or coral sand, from the intertidal zone to approximately 50 m water depth, and are most prolific in 2 to 10 m water depth. They can be found adjacent to offshore islands, as well as associated with intertidal and subtidal hard substrate areas adjacent to the mainland coast (CALM, 2005; CALM & MPRA, 2005; DEC, 2007). Seagrasses in the region often grow in association with macroalgae. The main seagrasses of the region are small, ephemeral species that depend on light for photosynthesis, and have a seed bank in the surficial sediments that allows them to recover quickly from disturbance. Common species include *Halophila ovalis, Syringodium isoetifolium* and *Halodule uninervis*. Less common species known from the region are *Cymodocea angustata, Halophila spinulosa, Thallassia hemprichii* and *Thalassodendron ciliatum*. Most seagrasses grow in soft sediments, however, *Thalassodendron* attaches to rock.

Table 3-4: Habitats associated with receptors identified within the EMBA

Category	Receptor	Operational Area Presence	EMBA Presence	Relevant Events That May Impact on the Receptors
			Northwest Shelf Province	
Benthic Habitats	Coral reefs	✓	✓	***Unplanned*** • Hydrocarbon release due to surface loss of well control. • Diesel release from vessel collision.
	Seagrass	✓	✓	
	Macroalgae	✓	✓	
	Non-coral benthic invertebrates	✓	✓	***Planned*** • Seabed disturbance. • Planned operational discharges. • Planned chemical and residual hydrocarbon discharges ***Unplanned*** • Hydrocarbon release due to surface loss of well control. • Diesel release from vessel collision. • Unplanned release of solids.
Shoreline Habitats	Mangroves	✓	✓	***Unplanned*** • Hydrocarbon release due to surface well release. • Diesel release from vessel collision.
	Intertidal platforms	✓	✓	
	Sandy beaches	✓	✓	
	Rocky shorelines	✓	✓	

3.2.4 Terrestrial and shoreline habitats and soils

The terrestrial fauna habitats found onshore in the operational area are typical of those found in the Pilbara Region. The DCGP onshore pipelines reside within the Littoral, Cheerawarra and Horesefalt land systems, which are defined as coastal mudflats, clay plains and sandy coastal plains. Shoreline habitat types found within the regional area include mangroves, sandy beaches, intertidal and subtidal zones and rocky shorelines (Figure 3-5).

Vegetation within the onshore operational area includes two communities that are on the WA list of priority ecological communities (PECs):

- Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (PEC 1)
- Stony Chenopod associations of the Roebourne Plains (PEC 2).

Locations of these PECs in relation to the DC pipeline are shown in Figure 3-6Figure 3-6 and indicate the pipeline intercepts a very small portion of both of these PECs. Both priority ecological communities are listed as Priority 1 by the Department of Biodiversity Conservation and Attractions (DBCA), defined as being

- ‘poorly-known ecological communities: Ecological communities that are known from very few occurrences with a very restricted distribution’
- ‘occurrences are believed to be under threat either due to their limited extent or being on lands under immediate threat (e.g. within agricultural or pastoral lands)’.

The Roebourne Plains coastal grasslands with gilgai micro-relief occur on deep cracking clays that are self-mulching and emerge on depositional surfaces (DBCA, 2019). The Roebourne Plains gilgai grasslands occur on microrelief of deep cracking clays, surrounded by clay plains/flats and sandy coastal and alluvial plains. The gilgai depressions supports ephemeral and perennial tussock grasslands dominated by Sorghum sp. and *Eragrostis xerophila* (Roebourne Plains grass) along with other native species including *Astrebla pectinata* (barley mitchell grass), *Eriachne benthamii* (swamp wanderrie grass), *Chrysopogon fallax* (golden beard grass) and *Panicum decompositum* (native millet). Threats identified for this PEC include grazing, clearing for mining and infrastructure and urban development, weed invasion and basic raw material extraction.

The Stony Chenopod association of the Roebourne Plains area is dominated by *Eragrostis xerophila* and chenopods growing in saline clay soils with dense surface strew of pebbles and cobbles (DBCA, 2019). The association appears to be uncommon and is likely to be linked with the Cheerawarra land system. Only one occurrence has been located to date (Roebourne Airport), however it is likely some other small areas remain. Threats include grazing, clearing, and weeds especially buffel grass.

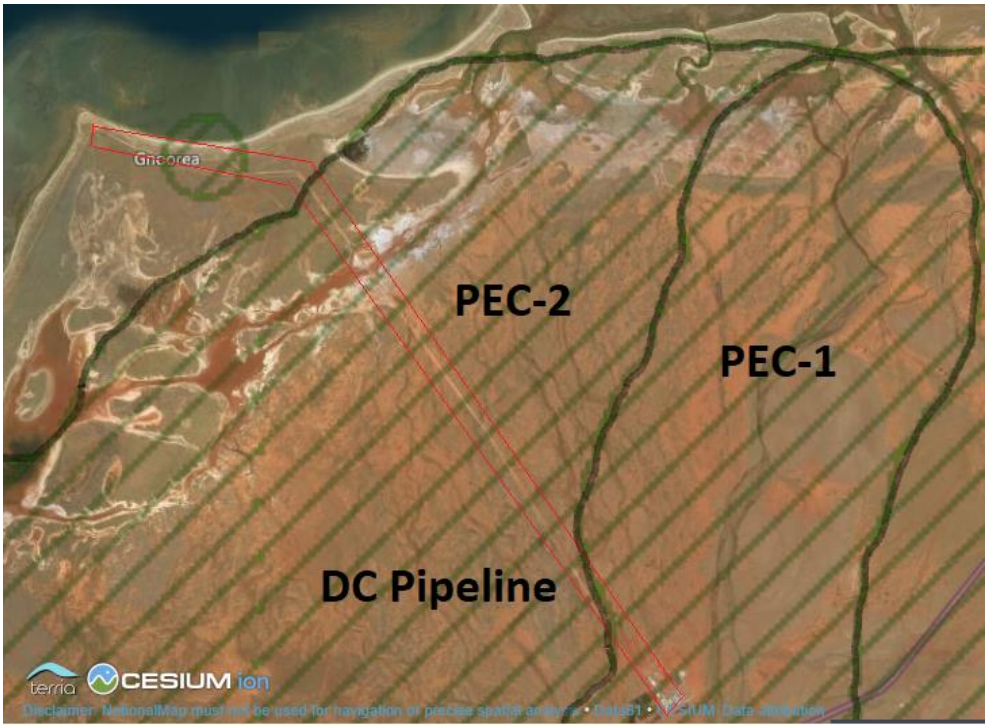


Figure 3-6: Location of Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (PEC 1), and stony chenopod associations of the Roebourne Plains (PEC 2) in relation to the DC pipeline

Source: DBCA (2019)

A monitoring program assessing the health of onshore vegetation association has been carried out biannually since the third quarter of 2009. Monitoring has indicated that changes in health are related to 'seasonal' factors, largely rainfall, and that there has been no adverse impact from Santos activities. In August 2013, monitoring identified that the pipeline easement rehabilitation transects shared 50% of species with the analogue transects, after having reached 57% in June 2012 (AEL, 2013). Vegetation monitoring has now ceased in accordance with advice from the regulator.

As described above, the vegetation within the operational area was cleared in accordance with MS 795. Areas of vegetation clearing were then rehabilitated in accordance with the conditions of MS 795 and weed and vegetation management activities have been undertaken.

The OEPA undertook an on-site audit in October 2013. It was noted during the audit that there are external pressures impacting on the pipeline easement rehabilitation. These pressures and associated impairment of rehabilitation efforts include public vehicle access, road maintenance activities and cattle. These are activities that are not directly linked to Santos' activities and are beyond its management control. The vegetation within the operational area is considered low quality.

A search of the Australian Soil Resource Information System has confirmed that there is a low-moderate probability of acid sulphate soils being present within the onshore operational area.

3.2.4.1 Groundwater

Studies undertaken in the vicinity of the DCGP identified the presence of a shallow aquifer resource in the immediate area and the coastal zone a few kilometres north and south of the DCGP. The subsurface ground water flows are considered to have an hydraulic gradient directed from southeast to northwest towards the ocean, due to the elevated topography inland and the general flow of surface run off to the northwest For existing operations at the DCGP and the nearby Devil Creek accommodation village, groundwater is abstracted from multiple bores at both locations under groundwater licence (GWL) 166033. This licence is valid from 22 December 2017 to 21 December 2027.

In 2007 prior to construction, ground water levels at DCGP ranged from 9.7 to 10.7 meters below ground level.

Santos currently implement a groundwater monitoring program and report on the results annually to DWER.

3.2.4.2 Mangroves

Mangroves are recognised as significant as productive coastal forest systems, providing habitat and shelter for infauna, epifauna, gastropods, crustaceans, fish and other marine species. Mangroves are important nursery areas for fish, lobster and prawn species, some of which are targeted by recreational and commercial fishers (Department of Environment and Conservation (DEC, 2007). Mangroves may also provide shelter for other species such as juvenile turtles (DEC, 2007). Ospreys (*Pandion haliaetus*) and white-bellied sea eagles (*Haliaeetus leucogaster*) roost in mangroves, while Brahminy kites (*Haliastur indus*) and a range of smaller birds nest in them (DEC, 2007). Mangroves are also recognised for their capacity to protect coastal areas from erosion due to storms and storm surge.

The regional mangroves of mainland and islands from Exmouth to Broome represent Australia's only 'tropical-arid' mangroves. There are no unusual, endemic or restricted mangrove species in WA; all species are common and widespread elsewhere, either in northern Australia, or in the Indo-Pacific region proximal to northern Australia.

Mangroves are most abundant and diverse in embayments and connective tidal lands, which feature along the Pilbara coast. Generally, most mangrove stands have more than one species. *Avicennia marina* is the most abundant species in the Pilbara, and forms a sparse, single-species stand on the western face of Gnoorea Point

Mangroves are found in extensive stretches along many creeks and watercourses on the mainland coast. They are also found on the Montebello and Lowendal islands, along the south eastern and southern shores of Barrow Island and in sheltered pockets on the offshore islands of the Dampier Archipelago.

Plate 3-5: Gnoorea Point mangroves

3.2.4.3 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, which will influence the profile of each beach through varying rates of erosion and accretion. They are found across the northwest of WA and vary in length, width and gradient. They are interspersed among areas of hard substrate (e.g. sandstone) that form intertidal platforms and rocky outcrops. Sandy beaches provide habitat for a variety of burrowing invertebrates and subsequently provide foraging areas for shorebirds.

Sandy beaches can also provide an important habitat for turtle nesting, particularly at Barrow, Montebello and Lowendal islands. Further information on turtle breeding and nesting habits is provided in Figure 3-12 and Appendix C.

Sandy habitats are also important for birds at the Montebello and Lowendal islands. For example, oyster catchers and ruddy turnstones feed along beaches and rocky shorelines, while crested terns are known to nest on sandy beaches.

3.2.4.4 Rocky shorelines

Rocky shorelines can include pebble/cobble, boulders, rocky limestone cliffs and horizontal rock platforms. Intertidal reef platforms are in the intertidal zone and consist of hard bedrock. Examples include areas with or without a sediment veneer of varying thickness. Rocky shoreline formations offer habitat to a range of intertidal species including invertebrates and shorebirds. Rocky shorelines are found across the region and are often indicative of high wave energy areas where sand deposition is limited or restricted.

3.2.4.5 Tidal zones

Shielded habitats of sand, silt or mud in protected environments that collect deposited marine sediments are located on the western side of Gnoorea Point, and the eastern side of Pelican Point (Figure 3-5Figure 3-5). Further afield, they are also found in the Montebello Islands. Some areas exist on the eastern and southern shore of the adjacent Barrow Island (DEC, 2007). This habitat type is not extensive; however, due to the high diversity of infauna (particularly molluscs) found in this habitat, it is important for biodiversity conservation. The habitat type is generally not found in the Dampier Archipelago, but these communities do exist in the northern half of the Ningaloo Marine Park associated with mangrove communities (Department of Conservation and Land Management (CALM) & Marine Parks and Reserves Authority (MPRA), 2005).

The infauna found in the intertidal zone form an important food source for invertebrates that in turn are an important food source for resident and migratory shorebirds. In addition, during high tide, the intertidal sand flats provide foraging habitats for sharks and shovelnose rays (DEC, 2007).

Intertidal habitats support a diverse assemblage of vertebrates and invertebrates, particularly in vegetated areas. Coral reef communities located in the intertidal zone include the reef crest, shallow reef fronts, reef flat and shallow back reef zones with a variation in live coral and macroalgal coverage. Subtidal communities include the upper seaward reef slope, sheltered back reef, deep lagoonal reef and bommie clusters with a high percentage of hard corals, macroalgae and coralline algae (Bancroft, 2003). Intertidal platforms can support extensive macroalgal communities with a range of faunal diversity, including sponges, ascidians and soft corals (Chevron Australia, 2010).

3.2.5 Terrestrial flora

There are no Declared Rare Flora within the operational area or EMBA.

While the species *Eremophila forrestii* subsp *forrestii* has no formal conservation status, discussions between investigating botanists and the WA Department of Water and Environmental Regulation (DWER) confirmed that the heath form of this species and its location, at the northern-most extent of its range in this location, is significant (AES, 2007a).

3.2.5.1 Weeds

No Declared Weeds were found during the environmental assessment phase of the DCGP project.

The construction of the DC supply pipeline was completed in June 2010 and was immediately followed by rehabilitation of the impacted area, which is adjacent to Forty Mile Beach Road. Rehabilitation works occurred over approximately 24 hectares and included ripping and respreading of stored topsoil over the cleared pipeline easement. Since September 2010, monitoring has been undertaken annually to progress against the requirements of Ministerial Statement 795 (MS 795), Condition 6-1, within three years.

Santos has now completed rehabilitation monitoring along the gas pipeline easement and met the conditions of MS 795.

Weed cover has been calculated as the distance of plant cover along the line intercept transect, multiplied by the estimated percentage foliar cover. Average weed cover was compared among rehabilitation and analogue sites using a linear model. Although average weed cover was higher in rehabilitation transects than in analogue transects, the variation amongst weed levels meant that a statistically significant difference between the treatments could not be demonstrated (AES, 2013). In August 2013, monitoring identified that the pipeline easement rehabilitation transects shared 50% of species with the analogue transects, after having reached 57% in June 2012.

As mentioned above, the OEPA undertook an on-site audit in October 2013. It was noted during the audit that there are external pressures impacting on the pipeline easement rehabilitation. These external pressures include public vehicle access, road maintenance activities and cattle as well as presence of invasive species which are not a result of Santos' activities and beyond its management control.

Buffel grass (*Cenchrus ciliaris*) is dominant within the onshore gas supply pipeline corridor; however, the distribution and abundance of this weed is consistent with the existing proliferation prior to project commencement (AES, 2013).

3.2.6 Protected and significant areas

There are a number of Matters Protected Under the EPBC Act that lie within the operational area and EMBA; these are listed in Table 3-5 and shown in Figure 3-7 and Figure 3-9. These areas are further described in Appendix C.

There are no World Heritage Areas identified in the EPBC PMST searches as occurring within the operational area or EMBA.

There are no wetlands of national importance found in the operational area or EMBA.

One National Indigenous Heritage area, the Dampier Archipelago (including Burrup Peninsula) is located within the EMBA. These areas are shown in Figure 3-8 and are further discussed in Appendix C.

The EMBA overlaps a number of Australian Marine Parks (AMPs) as well as State Marine Parks and Marine Management Areas (Table 3-5) and (Section 3.2.6.1)).

Key ecological features (KEFs) that are components of the marine ecosystem that are considered to be important for biodiversity or ecosystem function and integrity of the Commonwealth Marine Area are also included in the DCCEEW EPBC Act Protected Matters Search Tool results (Appendix C). No KEFs intercept the DC supply pipeline corridor or EMBA. The closest KEFs to the operational area are the Ancient Coastline at 125 m Depth Contour (located 88.7 km north from the closest edge of the operational area), and Glomar Shoals (79 km north-east) (Figure 3-9).

Table 3-5: Distance from operational area boundary to protected areas within the EMBA

Value/ Sensitivity	Name of Protected or Significant Area	Zone or IUCN Classification	Presence in operational area	Presence in MEVA CSB	Presence in MEVA HDD	Presence in EMBA	Distance to operational area
National Heritage	Dampier Archipelago (including Burrup Peninsula)	-	No	Yes	Yes	Yes	12 km
Australian Marine Parks	Montebello AMP	Multiple Use Zone (IUCN VI)	No	Yes	No	Yes	37 km
	Dampier AMP	Habitat Protection Zone (IUCN IV) National Park Zone (IUCN II) Multiple Use Zone (IUCN VI)	No	Yes	No	Yes	56 km
State marine reserves	Montebello Islands Marine Park	Sanctuary Zone Special Purpose Zones Recreation Zones General Use Zones	No	Yes	No	Yes	72 km
	Barrow Island Marine Park	Sanctuary Zone	No	Yes	No	Yes	109 km
	Barrow Island Marine Management Area	Unclassified	No	Yes	No	Yes	76 km

3.2.6.1 Australian Marine Parks and State Marine Parks, Management Areas and Reserves

AMPs are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas. Management plans for AMPs have been developed and came into force on 1 July 2018. Under these plans, Australian marine parks 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. As the operational area does not overlap any AMPs, there are no AMPs that restrict the undertaking of the activity. Therefore, the activity will be undertaken in compliance with the AMP network zone rules. In the event of spill response operations being required within an AMP, emergency spill response activities are allowed in accordance with the Australian National Plan for Maritime Environmental Emergencies (MEE) without the need for a permit, class approval or activity license or lease issued by the Director of National Parks. The management zones associated with the AMPs identified within the EMBA, and the relevant principles and values are detailed in Table 3-6. Section 3.2.9 includes additional details regarding cultural heritage and marine parks.

The operational area does not intercept any Australian Marine Parks (AMPs), however the EMBA overlaps the Montebello AMP and Dampier AMP. Values for these AMPs are detailed in Table 3-7 with further discussion in Appendix C.

Oil and gas operations and associated oil spill response may be conducted in a Multiple Use Zone (IUCN VI) subject to the class approval and prescriptions within the North-West Marine Parks Network Management Plan (MPNMP) (Director of National Parks, 2018).

Table 3-6: Australian IUCN Reserve Management Principles (Schedule 8 of the EPBC Regulations 2000)

Applicable Marine Park	IUCN Principles
National Park (IUCN II)	
Dampier AMP	The reserve or zone should be protected and managed to conserve its natural condition according to the following principles.
	Natural and scenic areas of national and international significance should be protected for spiritual, scientific, educational, recreational or tourist purposes.
	Representative examples of physiographic regions, biotic communities, genetic resources, and native species should be perpetuated in as natural a state as possible to provide ecological stability and diversity.
	Visitor use should be managed for inspirational, educational, cultural and recreational purposes at a level that will maintain the reserve or zone in a natural or near natural state.
	Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur.
	Respect should be maintained for the ecological, geomorphologic, sacred and aesthetic attributes for which the reserve or zone was assigned to this category.
	The needs of indigenous people should be taken into account, including subsistence resource use, to the extent that they do not conflict with these 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 these principles should be recognised and taken into account.
Habitat/species Management Area (IUCN IV)	
Dampier AMP	The reserve or zone should be managed primarily, including (if necessary) through active intervention, to ensure the maintenance of habitats or to meet the requirements of collections or specific species based on the following principles.
	Habitat conditions necessary to protect significant species, groups or collections of species, biotic communities or physical features of the environment should be secured and maintained, if necessary, through specific human manipulation.
	Scientific research and environmental monitoring that contribute to reserve management should be facilitated as primary activities associated with sustainable resource management.
	The reserve or zone may be developed for public education and appreciation of the characteristics of habitats, species or collections and of the work of wildlife management.
	Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur.
	People with rights or interests in the reserve or zone should be entitled to benefits derived from activities in the reserve or zone that are consistent with these principles.
	If the reserve or zone is declared for the purpose of a botanic garden, it should also be managed for the increase of knowledge, appreciation and enjoyment of Australia's plant heritage by establishing, as an integrated resource, a collection of living and herbarium specimens of Australian and related plants for study, interpretation, conservation and display.
Managed Resource Protected Area (IUCN VI)	
Dampier AMP, Montebello AMP	The reserve or zone should be managed mainly for the ecologically sustainable use of natural ecosystems based on the following principles.
	The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term.

Applicable Marine Park	IUCN Principles
	Management practices should be applied to ensure ecologically sustainable use of the reserve or zone.
	Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles.

Table 3-7: Values of Australian Marine Parks overlapping the EMBA

Australian Marine Park	Management Zone/s	Values
Dampier Australian Marine Park	• Habitat Protection Zone (IUCN IV) • Multiple Use Zone (IUCN VI) • National Park Zone (IUCN II)	The Dampier Marine Park protected the following conservation values: • Significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province. • The Marine Park provides protection for offshore shelf habitats adjacent to the Dampier Archipelago, and the area between Dampier and Port Hedland, and is a hotspot for sponge biodiversity • The Marine Park includes several submerged coral reefs and shoals including Delambre Reef and Tessa Shoals • Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds, internesting habitat for marine turtles and a migratory pathway for humpback whales. • Port activities, commercial fishing and recreation, including fishing, are important activities in the Marine Park.
Montebello Australian Marine Park	• Multiple Use Zone (IUCN VI)	The Montebello Marine Park protected the following conservation values: • Significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province • One key ecological feature: the ancient coastline at the 125 m depth contour (valued as a unique seafloor feature with ecological properties of regional significance) • The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important seafloor feature and migratory pathway for humpback whales • Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks • Tourism, commercial fishing, mining and recreation are important activities in the Marine Park.

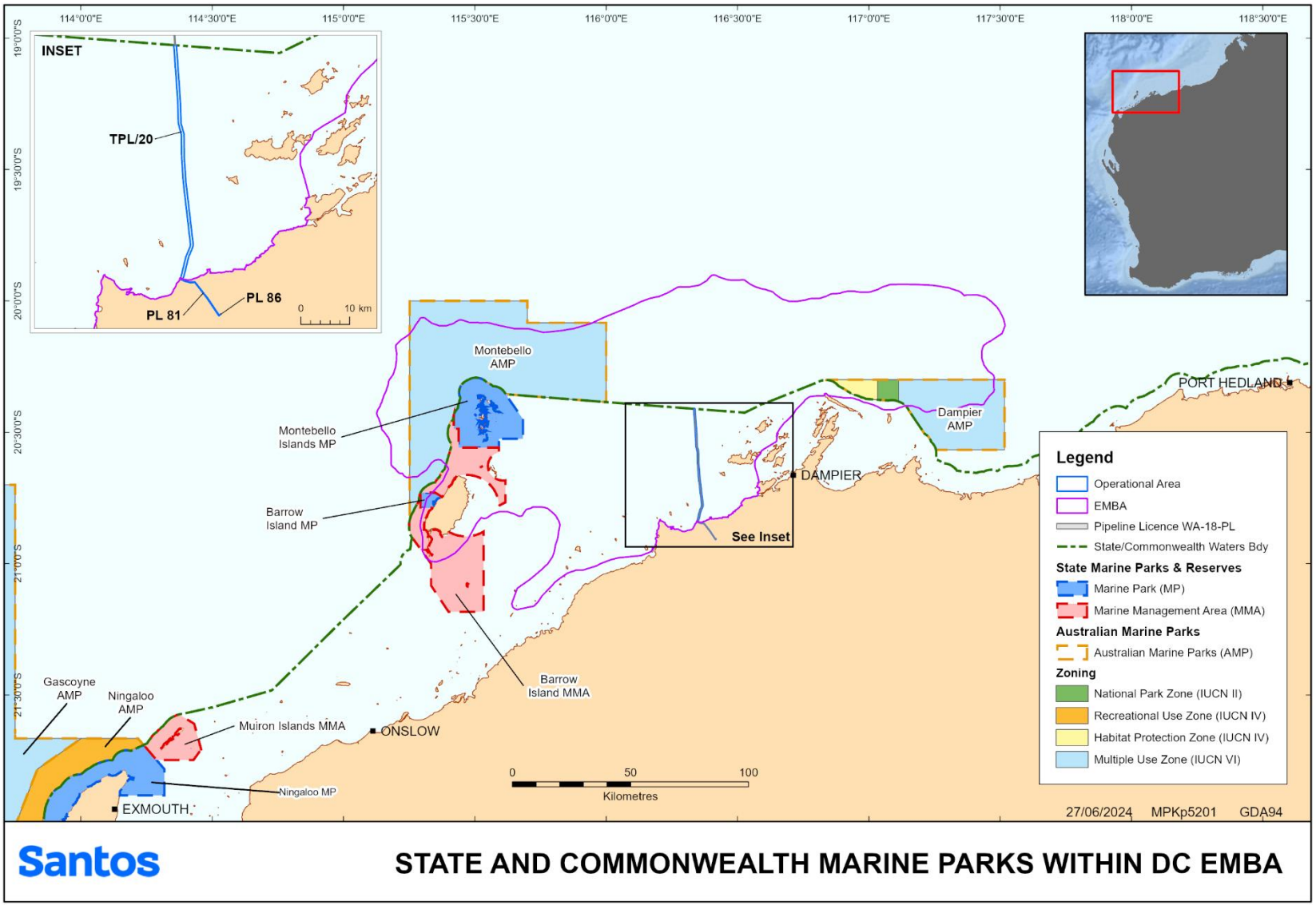


Figure 3-7: State and Australian marine parks and marine management areas in vicinity of Devil Creek operational area

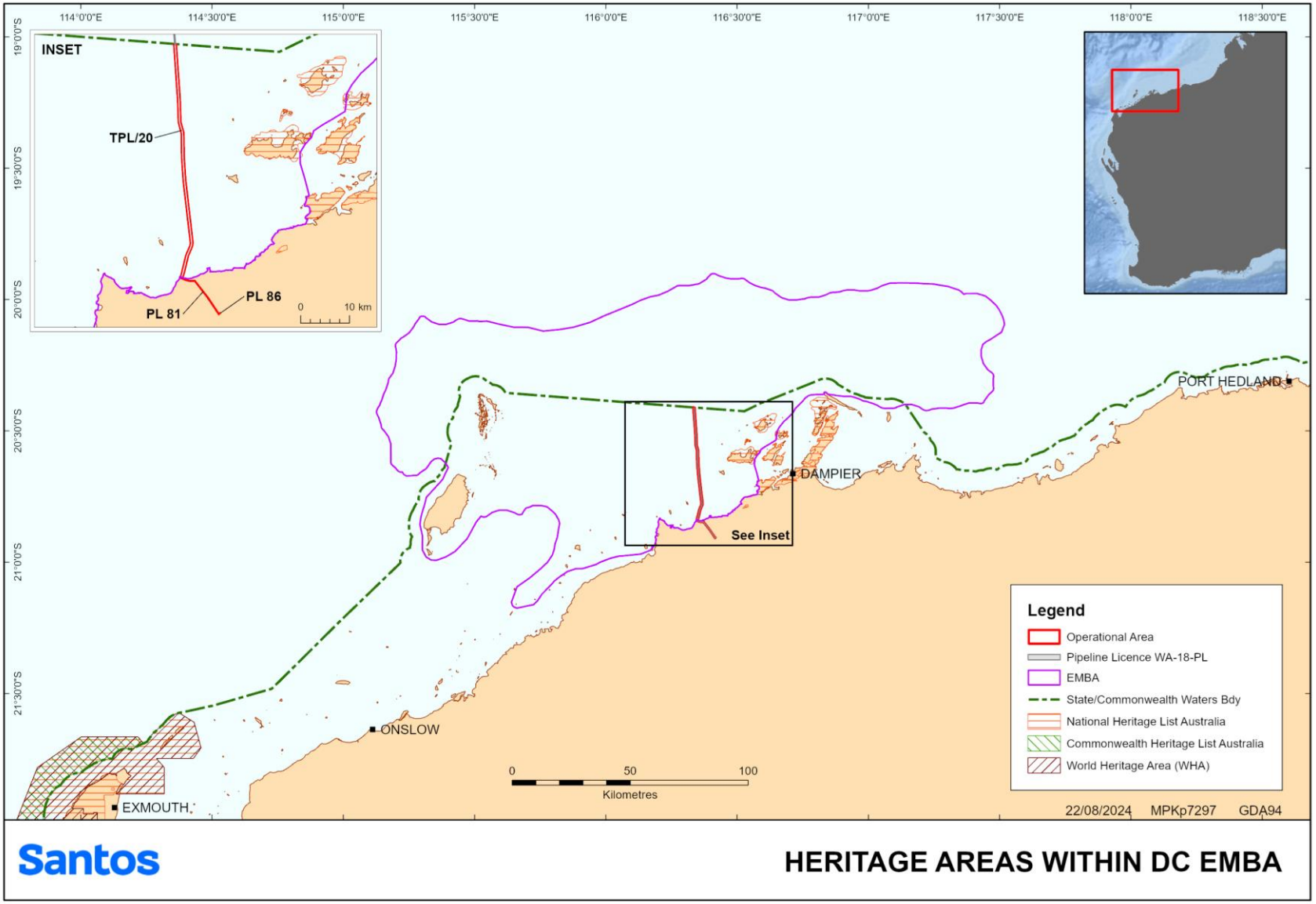


Figure 3-8: Heritage areas within DC EMBA

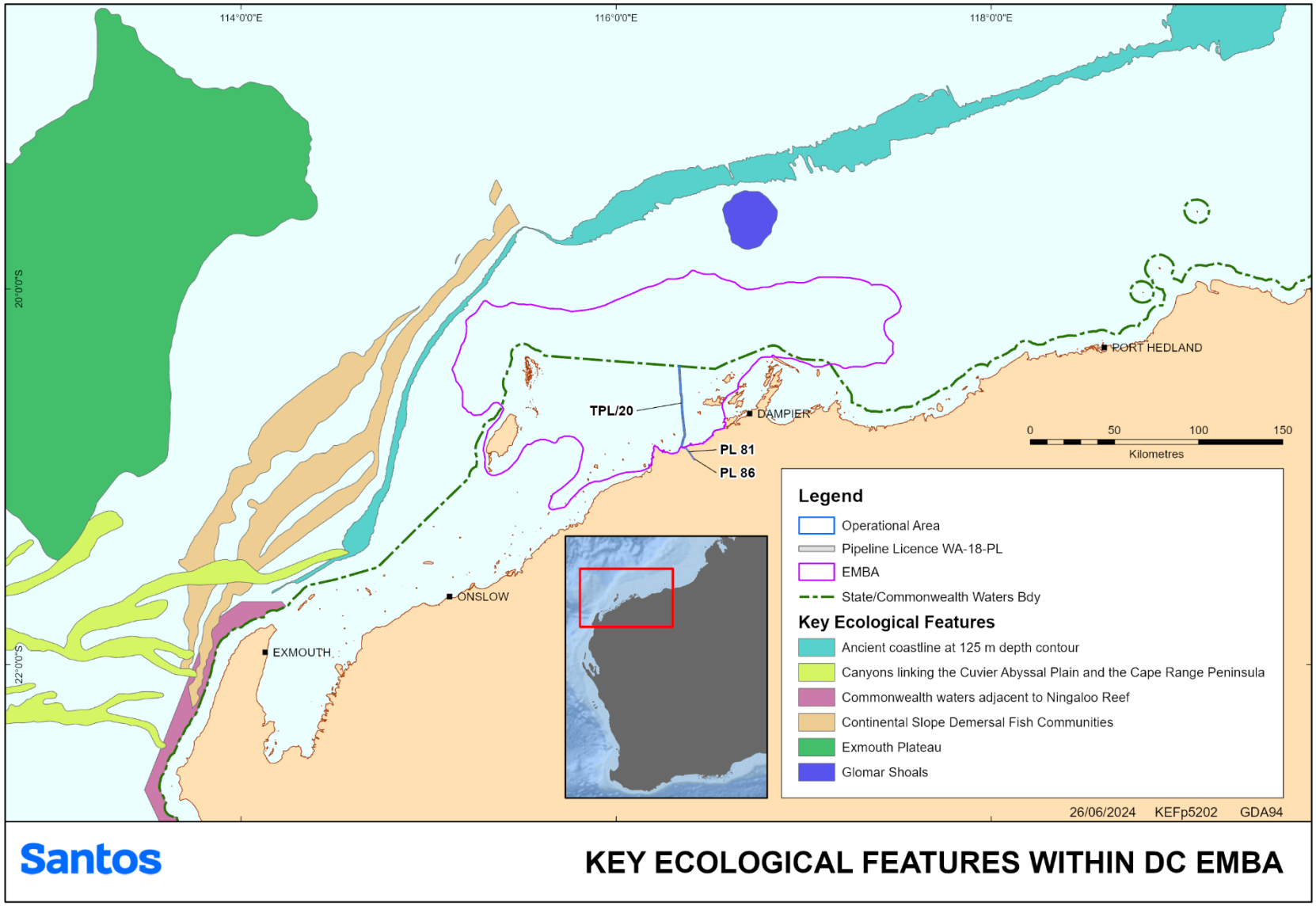


Figure 3-9: DC supply pipeline and marine key ecological features

3.2.6.2 State Marine Parks and Management Areas

The EMBA overlaps three State Marine Parks: Montebello Island Marine Park, Barrow Island Marine Park and Barrow Island Marine Management area. The operational area does not intercept any state marine parks, management areas or reserves.

Values for these Marine Parks are detailed in Table 3-8 with further discussion in Appendix C.

Table 3-8: State Marine Parks overlapping the EMBA

State Marine Park	Values
Barrow Island Marine Management Area	The Barrow Island Marine Management Area is offshore and relatively remote. It covers 114,500 hectares includes most of the waters around Barrow Island and the waters around the Lowendal Islands. The park is a significant breeding and nesting area for marine turtles and its waters support important coral reefs, unique mangrove communities and a diversity of tropical marine animals. Threatened green, hawksbill and flatback turtles regularly use the sandy beaches of Barrow Island for breeding and nesting.
Barrow Island Marine Park	Barrow Island Marine Park is a significant breeding and nesting area for threatened sea turtles and its waters support important coral reefs and a diversity of tropical marine animals. The marine park is 4,100 ha that supports large numbers of threatened green turtles on Turtle Bay. On the western side if Barrow Island, contains Biggada Reef that is only one of two significant fringing reefs in the Montebello/Barrow Island reserve system.
Montebello Islands Marine Park	More than 58,000 hectares of ocean surrounding 265 low-lying islands and islets that are fringed by coral reefs populated with colourful tropical fish. The Montebello Islands Marine Park, with its natural land and seascapes, barrier and fringing coral reefs, wide variety of wildlife and rich maritime heritage.

3.2.7 Marine fauna

Table 3-9 presents the threatened and migratory species within the operational area and the EMBA. These include all relevant Matters of National Environmental Significance (MNES) protected under the EPBC Act as identified in the protected matter search for the operational area and the EMBA. For each species identified, the extent of likely presence is provided, including any overlap with designated biologically important areas (BIAs). BIAs such as an aggregation, breeding, resting, nesting or feeding area or known migratory route for these species are shown in Figure 3-10 to Figure 3-16 and are described in Appendix C.

The PMST report identified 33 marine fauna species listed as ‘threatened’ (22 of which are listed as migratory also) and an additional 25 marine fauna species listed as ‘migratory’ within the operational area, and 51 marine fauna species listed as ‘threatened’ (27 of which are listed as migratory also) and an additional 32 marine fauna species listed as ‘migratory’ within the EMBA (Table 3-9). Other listed marine species that may occur within the operational area and the EMBA are provided in Appendix C. Note that terrestrial species that occur in the EPBC searches of the EMBA have been excluded where not relevant with respect to hydrocarbon concentrations of floating oil, entrained oil and dissolved aromatic hydrocarbons) and shoreline accumulations used to define the EMBA. Species that may occur on shorelines include shorebirds. Terrestrial mammals, reptiles (such as pythons) and bird species that do not have habitats along shorelines are excluded from marine fauna lists.

Terrestrial fauna which could be impacted by an onshore loss of containment from the DC supply pipeline or DC gas sales pipeline are identified within Table 3-9**.**

Relevant conservation advices, recovery plans and management plans for marine fauna identified in the PMST are provided in Table 3-11.

Table 3-9: Protected species and communities within the operational area and the EMBA

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	**Scientific Name**															
Protected Species and Communities: Fish and Sharks																
Whale shark	*Rhincodon typus*	V, M	M	✓	Species or species habitat may occur within area Foraging, feeding or related behaviour known to occur within area	X	N/A	✓	Species or species habitat known to occur within area Overlap with foraging BIA Foraging, feeding or related behaviour known to occur within the area	✓	Species or species habitat may occur within area	✓	Foraging, feeding or related behaviour known to occur within area Overlap with foraging BIA	✓	Species or species habitat may occur within area	***Planned*** • Noise emissions • Light emissions • Operational discharges • Planned chemical and residual hydrocarbon discharges • Spill response operations ***Unplanned*** • Hydrocarbon spills • Hazardous liquid releases (marine environment) • Marine fauna interaction • Introduction of invasive marine species
Grey nurse shark (west coast population)	*Carcharias taurus* (west coast population)	V, M	V	✓	Species or species habitat likely to occur within area	X	N/A	✓	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	✓	Species or species habitat likely to occur within area	
Great white shark	*Carcharodon carcharias*	V, M	V	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Dwarf sawfish	*Pristis clavata*	V, M	M	✓	Species or species habitat known to occur within area	X	N/A	✓	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	✓	Species or species habitat known to occur within area	
Freshwater sawfish	*Pristis pristis*	V, M	M	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Green sawfish	*Pristis zijsron*	V, M	V	✓	Species or species habitat known to occur within area	X	N/A	✓	Species or species habitat known to occur within area	✓	Breeding likely to occur within area	✓	Species or species habitat known to occur within area	✓	Breeding likely to occur within area	
Narrow sawfish	*Anoxypristis cuspidata*	M	M	✓	Species or species habitat likely to occur within area	X	N/A	✓	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	✓	Species or species habitat likely to occur within area	
Oceanic whitetip shark	*Carcharhinus longimanus*	M	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	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	✓	Species or species habitat may occur within area	
Shortfin mako	*Isurus oxyrinchus*	M	M	X	N/A	X	N/A	✓	Species or species habitat likely	X	N/A	✓	Species or species habitat likely	X	N/A	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
									to occur within area				to occur within area			
Longfin mako	*Isurus paucus*	M	M	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	
Reef manta ray	*Manta alfredi*	M	M	✓	Species or species habitat known to occur within area	X	N/A	✓	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	✓	Species or species habitat known to occur within area	
Giant manta ray	*Manta birostris*	M	M	✓	Species or species habitat likely to occur within area	X	N/A	✓	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	✓	Species or species habitat likely to occur within area	
Blind gudgeon	*Milyeringa veritas*	V	V	X	N/A	X	N/A	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	X	N/A	
Scalloped hammerhead shark	*Sphyrna lewini*	CD	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Protected Species and Communities: Marine Mammals																
Humpback whale	*Megaptera novaeangliae*	M	Special conservation interest, M	✓	Species or species habitat known to occur within area Overlap with BIA for migration Breeding known to occur within area	X	N/A	✓	Breeding known to occur within area Overlap with BIA for migration (north and south)	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area Overlap with BIA for migration (north and south)	✓	✓	***Planned*** • Noise emissions • Operational discharges • Planned chemical and residual hydrocarbon discharges • Spill response operations ***Unplanned*** • Hydrocarbon spills • Hazardous liquid releases (marine environment) • Marine fauna interaction
Blue whale	*Balaenoptera musculus*	E, M	E	✓	Species or species habitat likely to occur within area	X	N/A	✓	Migration route known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	✓	
Sei whale	*Balaenoptera borealis*	V, M	E	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat may occur within area	X	✓	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
Fin whale	*Balaenoptera physalus*	V, M	E	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat may occur within area	X	✓	
Bryde's whale	*Balaenoptera edeni*	M	M	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	✓	
Orca, killer whale	*Orcinus orca*	M	M	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	✓	
Spotted bottlenose dolphin	*Tursiops aduncus* (Arafura/ Timor Sea populations)	M	M	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	✓	
Australian humpback dolphin	*Sousa sahulensis*	V, M	M	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	✓	
Dugong	*Dugong dugon*	M	M	✓	Species or species habitat known to occur within area	X	N/A	✓	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	✓	✓	
Australian snubfin dolphin	*Orcaella heinsohni*	V, M	M	✓	Species or species habitat likely to occur within area	X	N/A	✓	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 right whale	*Eubalaena australia*	E, M	V	X	N/A	X	N/A	✓	Species or species habitat may occur within area	X	N/A	X	N/A	X	X	
Protected Species and Communities: Marine Reptiles																
Short-nosed seasnake	*Aipysurus apraefrontalis*	CE	CE	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	***Planned*** • Light emissions • Noise emissions • Operational discharges • Planned chemical and residual hydrocarbon discharges • Spill response operations ***Unplanned*** • Hydrocarbon spills
Leaf-scaled seasnake	*Aipysurus foliosqarma*	CE	CE	✓	Species or species habitat known to occur within area	X	N/A	✓	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	✓	Species or species habitat known to occur within area	
Loggerhead turtle	*Caretta caretta*	E, M	E	✓	Species or species habitat	✓	Breeding known to	✓	Breeding known to	✓	Species or species habitat likely	✓	Breeding known to	✓	Foraging, feeding or	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
					known to occur within area		occur within area.		occur within area Overlap with internesting buffer and nesting BIAs		to occur within area		occur within area Overlap with nesting and internesting buffer and nesting BIAs		related behaviour known to occur within area Overlap with interesting buffer BIA	• Hazardous liquid releases (marine environment) • Marine fauna interaction
Green Turtle	*Chelonia mydas*	V, M	V	✓	Breeding known to occur within area Overlap interesting buffer BIA	✓	Breeding known to occur within area	✓	Breeding known to occur within area Overlap with internesting, basking, foraging, nesting, migration corridor, mating, internesting buffer and aggregation BIAs	✓	Congregation or aggregation known to occur within area Breeding known to occur within area	✓	Breeding known to occur within area Overlap with internesting, nesting, foraging, mating, basking and internesting buffer BIAs	✓	Breeding known to occur within area Overlap with internesting, foraging, nesting, migration corridor, mating, internesting buffer BIAs	
Leatherback turtle	*Dermochelys coriacea*	E, M	V	✓	Breeding likely to occur within area	✓	Breeding likely to occur within area	✓	Breeding likely to occur within area	✓	Species or species habitat likely to occur within area Breeding likely to occur within area	✓	Breeding likely to occur within area	✓	Breeding likely to occur within area	
Hawksbill turtle	*Eretmochelys imbricata*	V, M	V	✓	Breeding known to occur within area Overlap interesting buffer BIA	✓	Breeding known to occur within area	✓	Breeding known to occur within area. Overlap with foraging, mating, internesting, migration corridor, internesting buffer and nesting BIAs	✓	Congregation or aggregation known to occur within area Breeding known to occur within area	✓	Breeding known to occur within area Overlap with mating, internesting, foraging, internesting buffer and nesting BIAs	✓	Breeding known to occur within area Overlap with foraging, mating, internesting, migration corridor, internesting buffer and nesting BIAs	
Flatback turtle	*Natator depressus*	V, M	V	✓	Breeding known to occ Species or species habitat likely to occur within area Overlap with internesting BIA and the internesting habitat buffer critical to	✓	Breeding known to occur within area	✓	Breeding known to occur within area Overlap with aggregation, nesting, migration corridor, internesting, mating, foraging and internesting buffer BIAs	✓	Congregation or aggregation known to occur within area. Breeding known to occur within area	✓	Breeding known to occur within area Overlap with nesting, mating, foraging and internesting buffer BIAs	✓	Breeding known to occur within area Overlap with nesting, migration corridor, internesting, mating, foraging and internesting buffer BIAs	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
					survival of species											
Saltwater crocodile	Crocodylus porosus	M	NA	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Protected Species and Communities: Birds																
Curlew sandpiper	*Calidris ferruginea*	CE, M	CE	✓	Species or species habitat known to occur within area	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	***Planned*** • Light emissions • Noise emissions • Operational discharges • Planned chemical and residual hydrocarbon discharges • Atmospheric emissions • Spill response operations ***Unplanned*** • Hydrocarbon spills • Hazardous liquid releases (marine environment) • Marine fauna interaction
Red knot	*Calidris canutus*	V, M	E	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	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	
Southern giant petrel	*Macronectes giganteus*	E, M	Specially protected, M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Eastern curlew	*Numenius madagascariensis*	CE, M	CE	✓	Species or species habitat known to occur within area	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Greater sand plover	*Charadrius leschenaultii*	V, M	V	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Red Goshawk	*Erythrotriorchis radiatus*	E	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Grey Falcon	*Falco hypoleucos*	V	N/A	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Asian Dowitcher	*Limnodromus semipalmatus*	V	N/A	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Night parrot	*Pezoporus occidentalis*	E	N/A	✓	Species or species habitat may	✓	Species or species habitat may	✓	Species or species habitat may	✓	Species or species habitat may	X	N/A	✓	Species or species habitat may	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
					occur within area		occur within area		occur within area		occur within area				occur within area	
Red-tailed tropicbird	*Phaethon rubricauda westralis*	E	N/A	✓	Species or species habitat likely to occur within area	X	N/A	✓	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	✓	Species or species habitat likely to occur within area	
Common noddy	*Anous stolidus*	M	N/A	✓	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	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	
Streaked shearwater	*Calonectris leucomelas*	M	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	
Lesser frigatebird	*Fregata ariel*	M	N/A	✓	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	✓	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	
Common sandpiper	*Actitis hypoleucos*	M	N/A	✓	Species or species habitat known to occur within area	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Sharp-tailed sandpiper	*Calidris acuminata*	V, M	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	
Pectoral sandpiper	*Calidris melanotos*	M	N/A	✓	Species or species habitat may occur within area Species or species habitat may occur within area overfly marine area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Osprey	*Pandion haliaetus*	M	N/A	✓	Species or species habitat known to occur within area	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Species or species habitat known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Bar-tailed godwit	*Limosa lapponica*	M	N/A	✓	Species or species habitat known to occur within area	✓	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	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	***Unplanned*** • Hydrocarbon spills • Hazardous liquid releases (marine environment)

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
Northern Siberian bar-tailed godwit	*Limosa lapponica menzbierii*	E	CE, Specially protected, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	✓	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	• Marine fauna interaction
Australian fairy tern	*Sternula nereis nereis*	V	V	✓	Breeding known to occur within area Overlap with foraging and breeding BIA	✓	Breeding known to occur within area	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding known to occur within area	✓	Breeding known to occur within area Overlap with breeding BIA (listed as Sternula nereis)	✓	Breeding known to occur within area Overlap with breeding BIA	
Fork-tailed swift	*Apus pacificus*	M	N/A	✓	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	✓	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	
Barn swallow	*Hirundo rustica*	M	N/A	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Grey wagtail	*Motacilla cinereal*	M	N/A	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Yellow wagtail	*Motacilla flava*	M	N/A	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Wedge-tailed shearwater	*Ardenna pacifica*	M	N/A	X	N/A	X	N/A	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding known to occur within area	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding known to occur within area Overlap with breeding BIA	
Greater frigatebird	*Fregata minor*	M	N/A	X	N/A	X	N/A	✓	Species or species habitat may occur within area	X	N/A	✓	Species or species habitat may occur within area	X	N/A	
Caspian tern	*Hydroprogne caspia*	M	N/A	X	N/A	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	
Bridled tern	*Onychoprion anaethetus*	M	N/A	X	N/A	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	X	N/A	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
White-tailed tropicbird	*Phaethon lepturus*	M	N/A	✓	Species or species habitat may occur within area	X	N/A	✓	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	✓	Species or species habitat may occur within area	
Christmas Island White-tailed Tropicbird	*Phaethon lepturus fulvus*	E	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Roseate tern	*Sterna dougallii*	M	N/A	X	N/A	X	N/A	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding known to occur within area Overlap with breeding BIA	✓	Breeding likely to occur within area Overlap with breeding BIA	
Little Tern	*Sternula albifrons*	V, M	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	✓	Species or species habitat may occur within area	
Oriental plover	*Charadrius veredus*	M	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Oriental pratincole	*Glareola maldivarum*	M	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Lesser crested tern	*Thalasseus bengalensis*	M	N/A	X	N/A	X	N/A	✓	Overlap with breeding BIA Not listed in PMST search; however, breeding BIA does overlap the EMBA and therefore this species is assumed to be within the EMBA	✓	Overlap with breeding BIA Not listed in PMST search; however, breeding BIA does overlap the EMBA and therefore this species is assumed to be within the EMBA	✓	Overlap with breeding BIA Not listed in PMST search; however, breeding BIA does overlap the CSB MEVA and therefore this species is assumed to be within the CSB MEVA	X	N/A	
Greater crested tern	*Thalasseus bergii*	M	N/A	X	N/A	X	N/A	✓	Breeding known to occur within area	✓	Breeding known to occur within area	✓	Breeding known to occur within area	X	N/A	
Indian Yellow-nosed Albatross	*Thalassarche carteri*	V, M	E	X	N/A	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	X	N/A	X	N/A	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	Scientific Name															
Common greenshank	*Tringa nebularia*	E, M	N/A	✓	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	✓	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	
White-winged fairy-wren (Barrow Island), Barrow Island black-and-white fairy-wren	*Malurus leucopterus edouardi*	V	N/A	X	N/A	X	N/A	✓	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	X	N/A	
Australian painted snipe	*Rostratula australis*	E	E	□	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Terrestrial Mammals																
Northern quoll	*Dasyurus hallucatus*	E	E	X	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	✓	Species or species habitat likely to occur within area	X	N/A	✓	Species or species habitat known to occur within area	***Planned*** • Atmospheric emissions • Spill response operations ***Unplanned*** • Hydrocarbon spills
Ghost bat	*Macroderma gigas*	V	V	X	N/A	✓	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	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Pilbara leaf nosed bat	*Rhinonicteris aurantia* (Pilbara form)	V	V	X	N/A	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	X	N/A	X	N/A	✓	Species or species habitat may occur within area	
Golden bandicoot (Barrow Island)	*Isoodon auratus barrowensis*	V	V	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	
Spectacled hare-wallaby (Barrow Island)	*Lagorchestes conspicillatus conspicillatus*	V	V	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	X	N/A	X	N/A	
Mala, rufous hare-wallaby (central Australia)	*Lagorchestes hirsutus* Central Australian subspecies	E	E	X	N/A	X	N/A	✓	Translocated population known to occur within area	X	N/A	✓	Translated population known to occur within area	X	N/A	
Barrow Island wallaroo, Barrow Island euro	*Osphranter robustus isabellinus*	V	V	X	N/A	X	N/A	✓	Species or species habitat likely to occur within area	X	N/A	X	N/A	X	N/A	

Value/Sensitivity		EPBC Act Status[1]	BC Act 2016[2]	Offshore operational area Presence	Particular Values or Sensitivities within Offshore operational area	Onshore operational area Presence	Particular Values or Sensitivities Within Onshore operational area	Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	CSB MEVA Presence	Particular Values or Sensitivities Within CSB MEVA	HDD MEVA Presence	Particular Values or Sensitivities Within HDD MEVA	Relevant Events
Common Name	**Scientific Name**															
Black-flanked rock-wallaby	*Petrogale lateralis lateralis*	E	E	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	X	N/A	X	N/A	
Boodie, burrowing bettong	*Bettongia lesueur* Barrow and Boodie Islands subspecies	V	CD	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	X	N/A	X	N/A	
Terrestrial Reptiles																
Pilbara Olive Python	*Liasis olivaceus barroni*	V	V	X	N/A	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	✓	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	***Planned*** • Spill response operations ***Unplanned*** • Hydrocarbon spills
Hamelin Ctenotus	*Ctenotus zastictus*	V	V	X	N/A	X	N/A	✓	Species or species habitat known to occur within area	X	N/A	X	N/A	X	N/A	

Note:

1 CE = Critically Endangered; E = Endangered; V = Vulnerable; M = Migratory; CD = Conservation Dependent

3.2.7.1 Biologically important areas and critical habitat

BIAs are areas that have been identified where threated or migratory species protected under the EPBC Act carry out critical lifecycle activities. In addition to BIAs, habitat critical for the survival of the species has also been identified for marine turtles and these are areas in addition to BIAs where marine turtles carry out critical lifecycle activities.

BIAs such as an aggregation, breeding, resting, nesting or feeding area or known migratory route for areas deemed habitat critical for the survival of a species within the operational area and EMBA are shown in Table 3-10, and Figure 3-10 to Figure 3-16, They are also described further in Appendix C.

The operational area overlaps with the internesting buffer BIAs for flatback, green, and hawksbill turtles (Figure 3-12 to Figure 3-15 as well as the habitats critical to the survival of flatback, green, and hawksbill turtles (Table 3-10).

Other BIAs the operational area overlaps is the humpback whale (migration), roseate tern (breeding), fairy tern (breeding) and the wedge-tailed shearwater (breeding).

3.2.7.2 Habitat Critical to the Survival of a Species

Habitat critical to the survival of species is defined by the EPBC Act Significant Impact Guidelines 1.1 Matters of National Environmental Significance as areas necessary:

- for activities such as foraging, breeding or dispersal
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species)
- to maintain genetic diversity and long term evolutionary development
- for the reintroduction of populations or recovery of the species.

The Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017) identifies draft habitat critical to the survival of a species for marine turtles as:

- nesting habitat critical to the survival of green, loggerhead, flatback and hawksbill turtles includes at least 70 per cent of nesting for the stock
- nesting habitat critical to the survival of olive ridley turtles includes all documented nesting areas in Queensland and Western Australia, and beaches where nesting has been recorded with greater than ten nesting females in the Northern Territory (noting inter-annual fluctuations)
- nesting habitat critical to the survival of leatherback turtles includes all areas where nesting has occurred in Australia since 1996
- nesting habitat critical to survival of marine turtles is of a geographically relevant scale.

For example, green turtles are known to move between islands of the Capricorn Bunker Group within a nesting season, while leatherback turtles may move up to 400 km within a season where relevant, nesting habitat determined to be critical to the survival of marine turtles includes areas that are: geographically dispersed; major and minor rookeries; mainland and island beaches; and winter or summer nesting to ensure the validity of long-term monitoring programs for assessing trends in nesting turtle abundance, all index beaches are considered habitat critical to survival of marine turtles internesting habitat critical to the survival of marine turtles is located immediately seaward of designated nesting habitat critical to the survival of marine turtles. The internesting habitat critical buffer for green, loggerhead, hawksbill, olive ridley and leatherback turtles is 20 km and 60 km for flatback turtles.

Habitat critical to the survival of marine turtles within the operational area and EMBA is described in Table 3-10.

Table 3-10: BIAs in the operational area and the EMBA

Species	BIA area	OA	OA with 20km light buffer[1]	Presences in			Habitat Critical within EMBA[2]
				MEVA HDD	MEVA CSB	EMBA	
Whale shark	Foraging	-	-	✓	✓	✓	N/A

[1] *20km buffer for receptors that have potential interaction with light based on recommendations from the National Pollution Guidelines for Wildlife (DCCEEW, 2023)*

[2] *Source: COA, 2017*

Species	BIA area	OA	OA with 20km light buffer[1]	Presences in			Habitat Critical within EMBA[2]
				MEVA HDD	MEVA CSB	EMBA	
Humpback whale	Migration (north and south)	✓	✓	✓	✓	✓	
Green turtle	Aggregation	-	-	-	-	✓	20 km internesting buffer: Adele Island, Barrow Island, Lacepede Islands, Montebello Islands (all with sandy beaches), Dampier Archipelago,
	Basking	-	-	-	✓	✓	
	Foraging	-	✓	✓	✓	✓	
	Internesting	✓	✓	-	✓	✓	
	Internesting buffer	✓	✓	✓	✓	✓	
	Mating	-	✓	✓	✓	✓	
	Migration corridor	-	✓	✓	-	✓	
	Nesting	-	✓	✓	✓	✓	
	Critical Habitat	✓	✓	✓	✓	✓	
Loggerhead turtle	Internesting buffer	-	✓	✓	✓	✓	20 km internesting buffer: Muiron Islands,
	Nesting	-	✓	-	✓	✓	
Hawksbill turtle	Mating	-	✓	✓	✓	✓	20 km internesting buffer: Dampier Archipelago (including Rosemary Island and Delambre Island), Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island), Lowendal Islands (including Varanus Island, Beacon Island and Bridled Island), Sholl Island
	Nesting	-	✓	✓	✓	✓	
	Internesting	-	✓	✓	✓	✓	
	Internesting buffer	✓	✓	✓	✓	✓	
	Foraging	-	✓	✓	✓	✓	
	Migration corridor	-	✓	✓	-	✓	
	Critical habitat	✓	✓	✓	✓	✓	
Flatback turtle	Mating	-	✓	✓	✓	✓	60 km internesting buffer: , Montebello Islands, Mundabullangana Beach, Barrow Island, Cemetery Beach, Dampier Archipelago (including Delambre Island and Hauy Island), coastal islands from Cape Preston to Locker Island
	Nesting	-	✓	✓	✓	✓	
	Internesting	-	✓	✓	-	✓	
	Internesting buffer	✓	✓	✓	✓	✓	
	Foraging	-	✓	✓	✓	✓	
	Aggregation	-	-	-	-	✓	
	Migration corridor	-	✓	✓	-	✓	
	Critical Habitat	✓	✓	✓	✓	✓	
Fairy tern	Breeding	✓	✓	✓	✓	✓	N/A
Roseate tern	Breeding	✓	✓	✓	✓	✓	N/A
Wedge-tailed shearwater	Breeding	✓	✓	✓	✓	✓	N/A
Lesser crested tern	Breeding	-	-	-	✓	✓	N/A

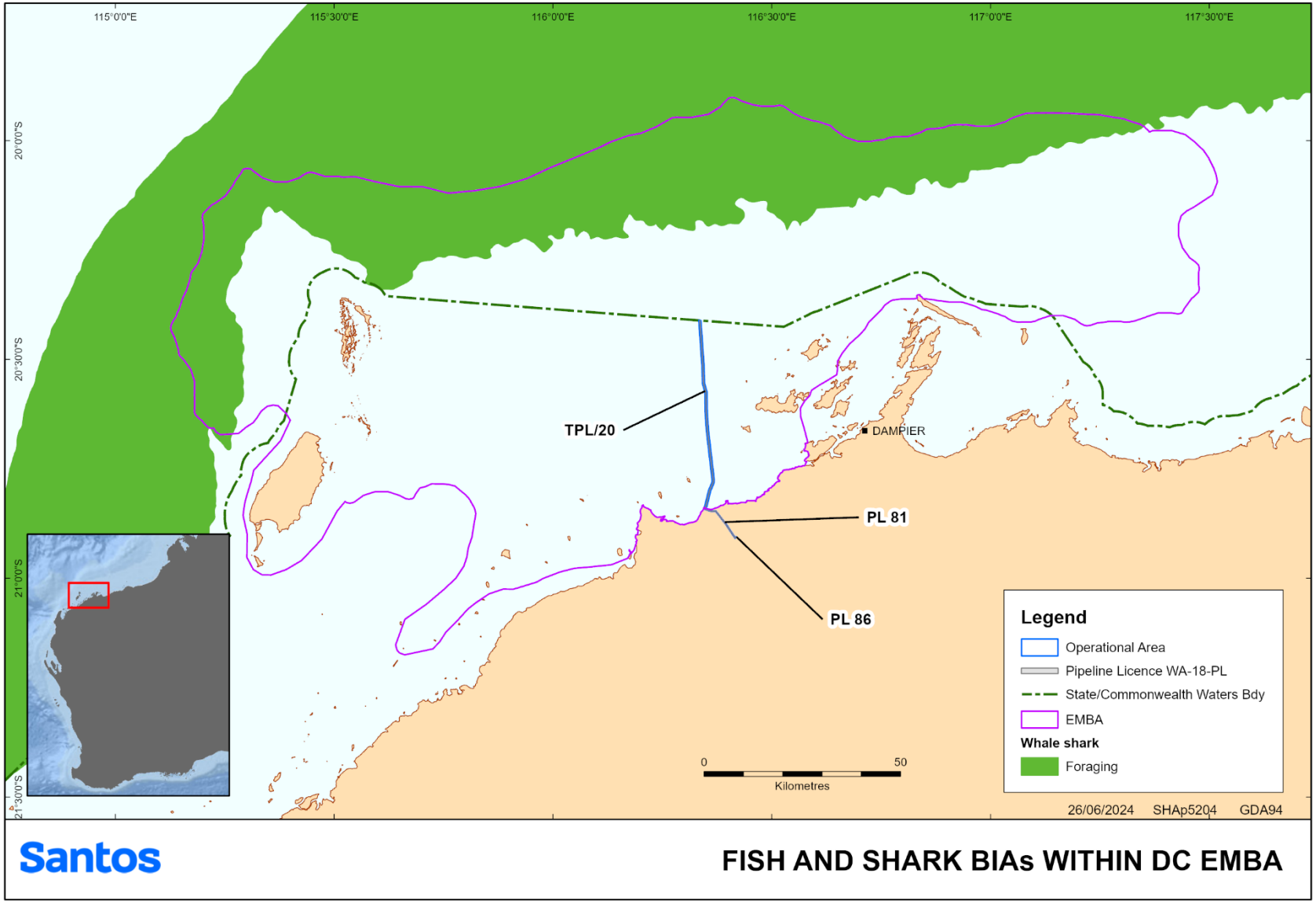


Figure 3-10: BIAs for fish and sharks in vicinity of operational area

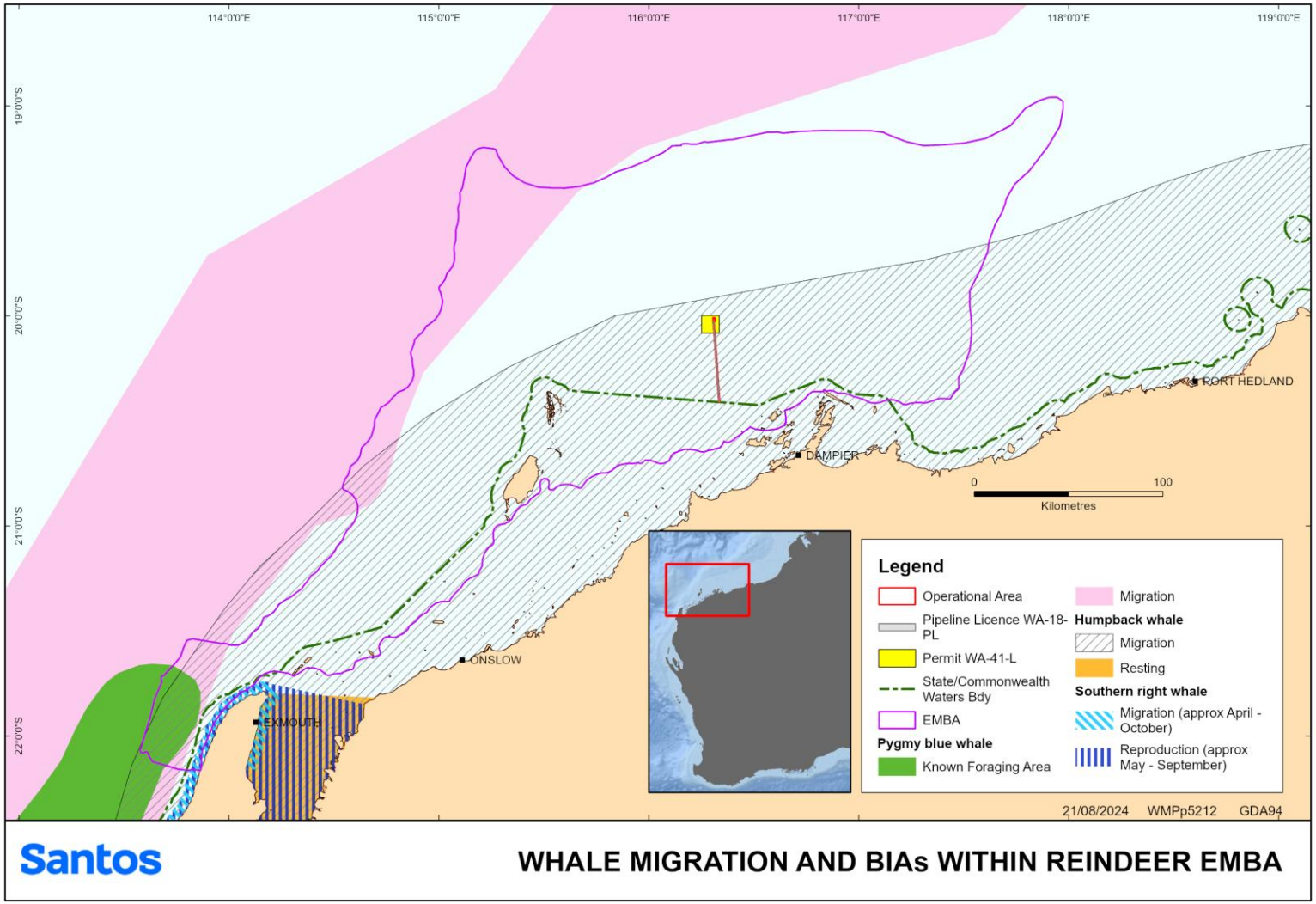


Figure 3-11: BIAs for EPBC listed whales in vicinity of operational area

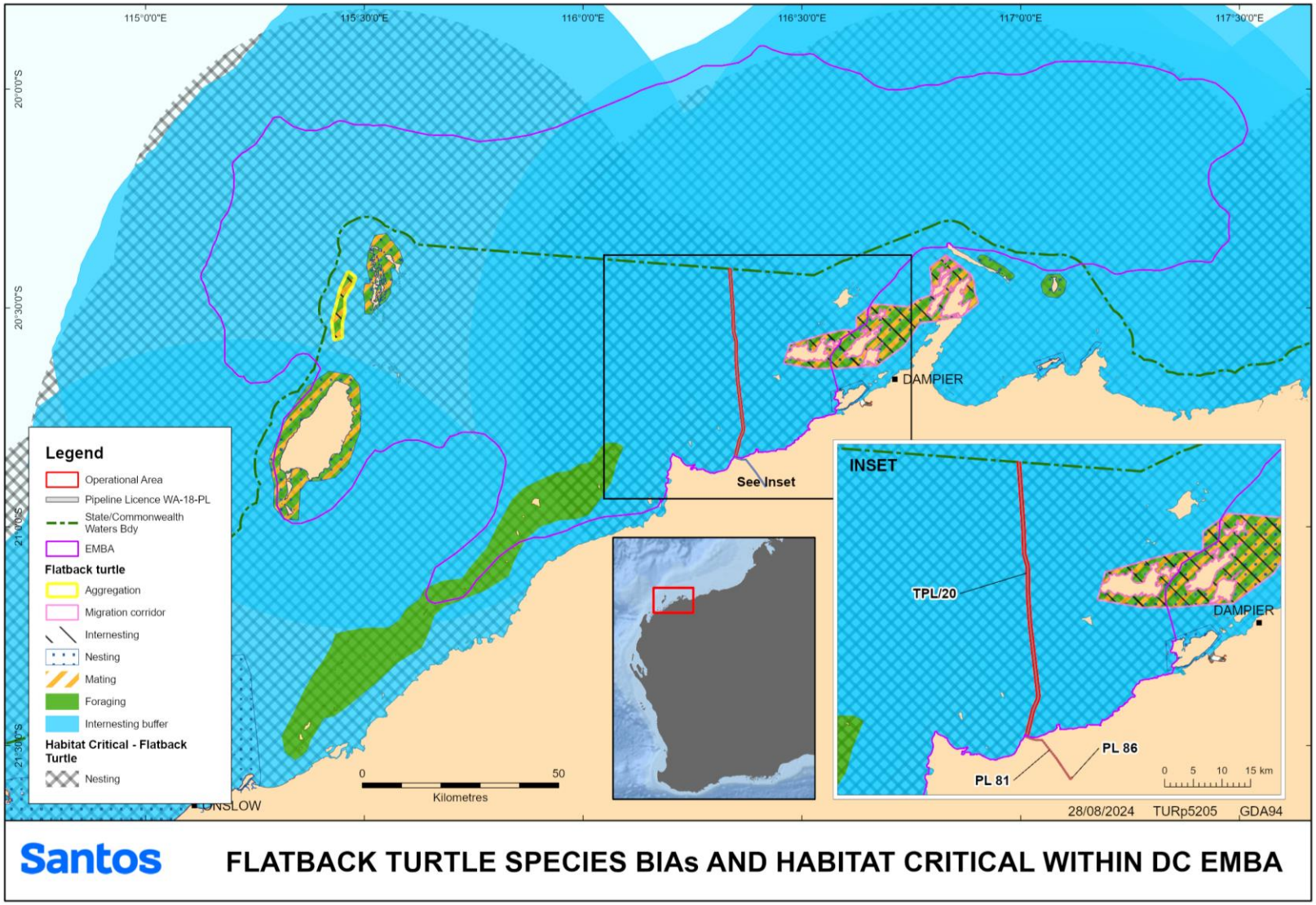


Figure 3-12: BIAs for flatback turtles in the vicinity of operational area

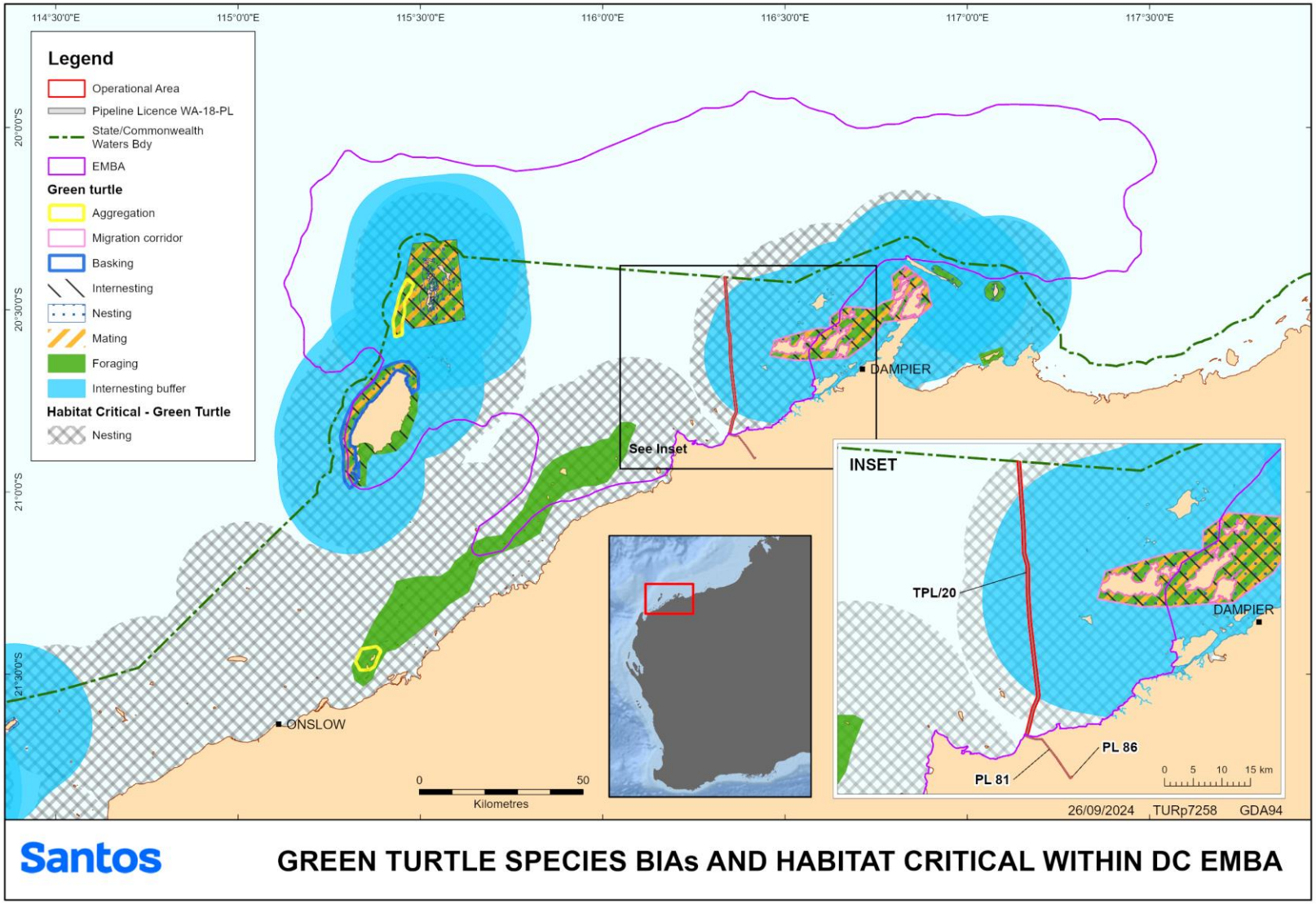


Figure 3-13: BIAs for green turtles in the vicinity of operational area

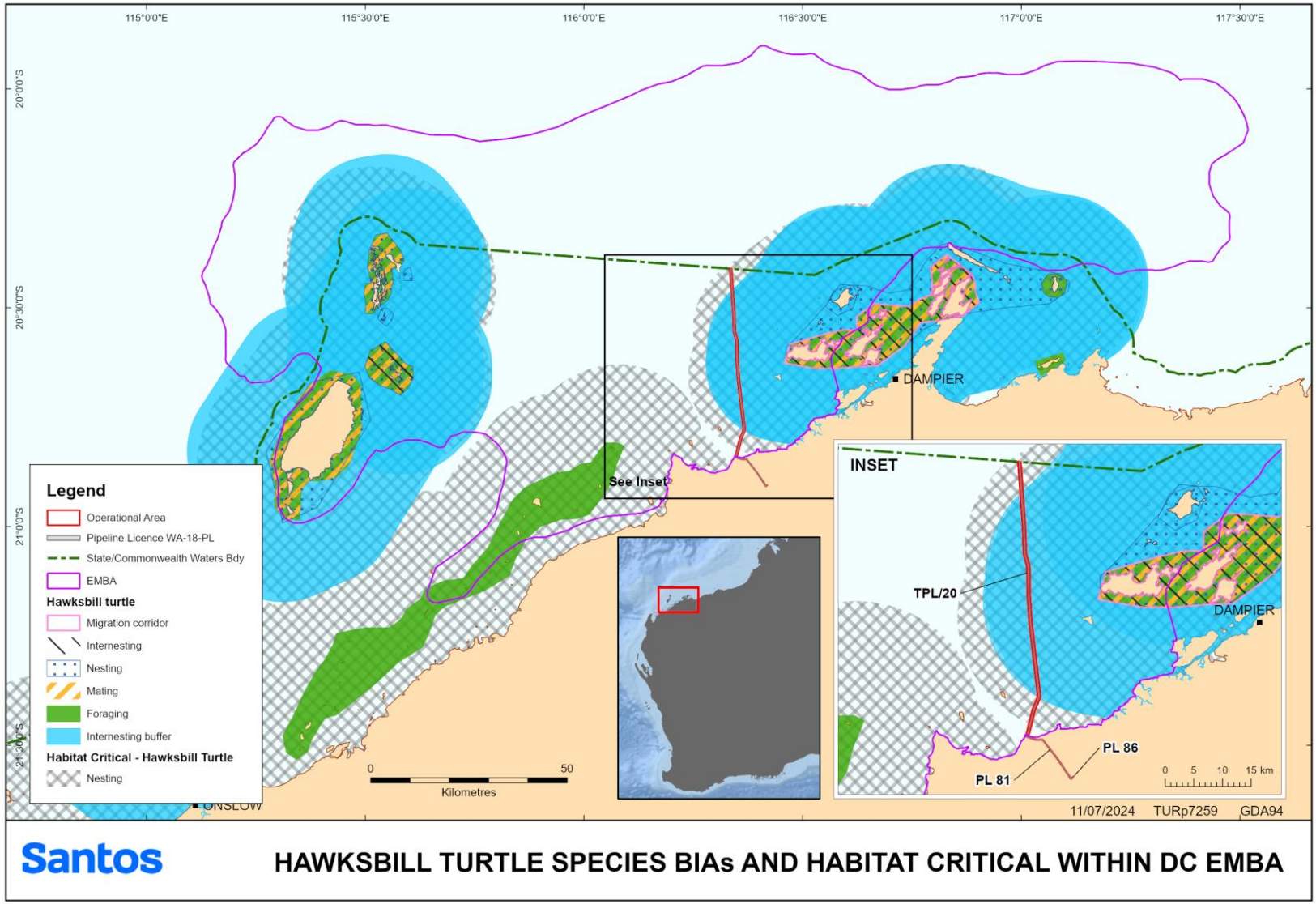


Figure 3-14: BIAs for hawksbill turtles in the vicinity of operational area

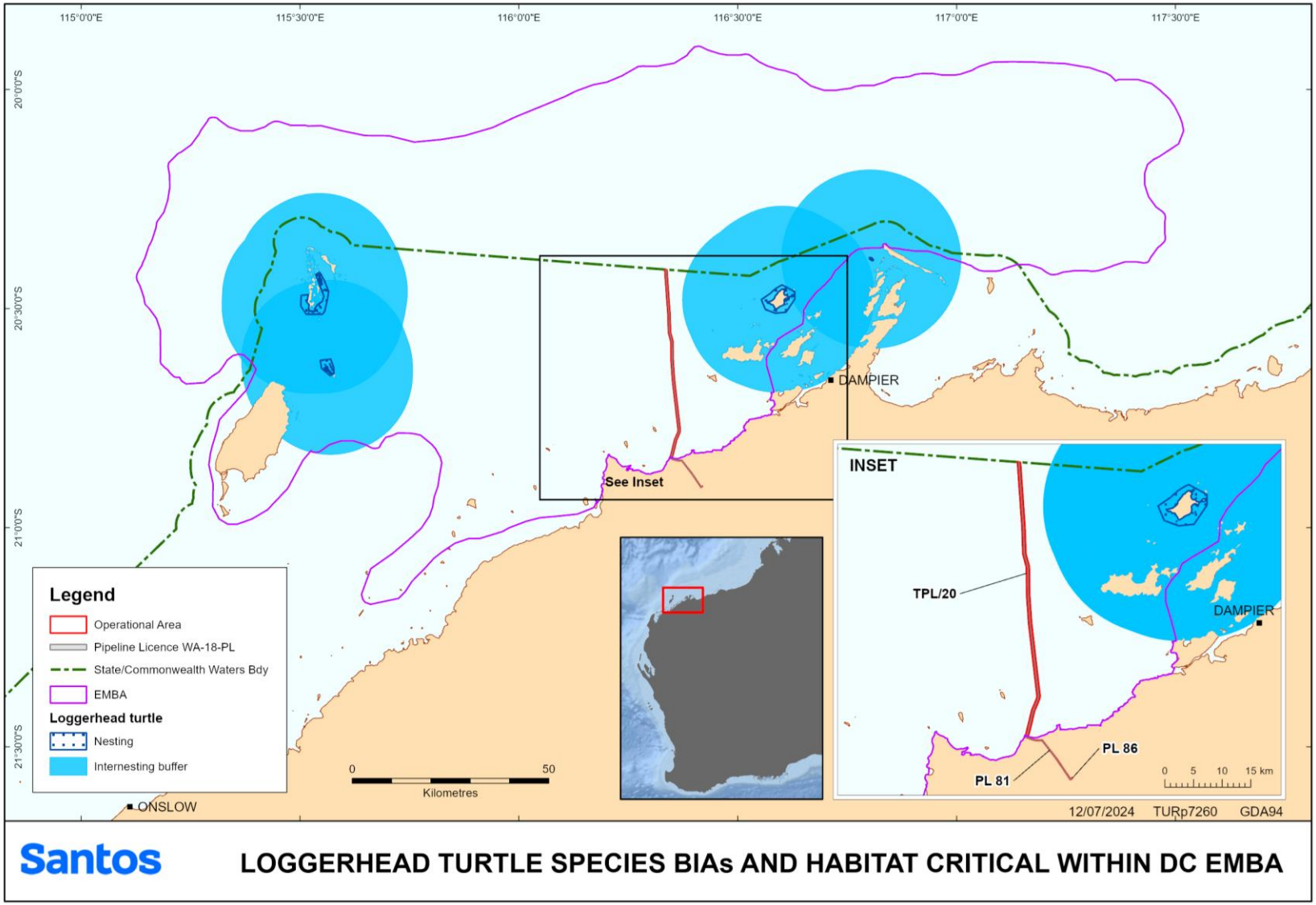


Figure 3-15: BIAs for loggerhead turtles in the vicinity of operational area

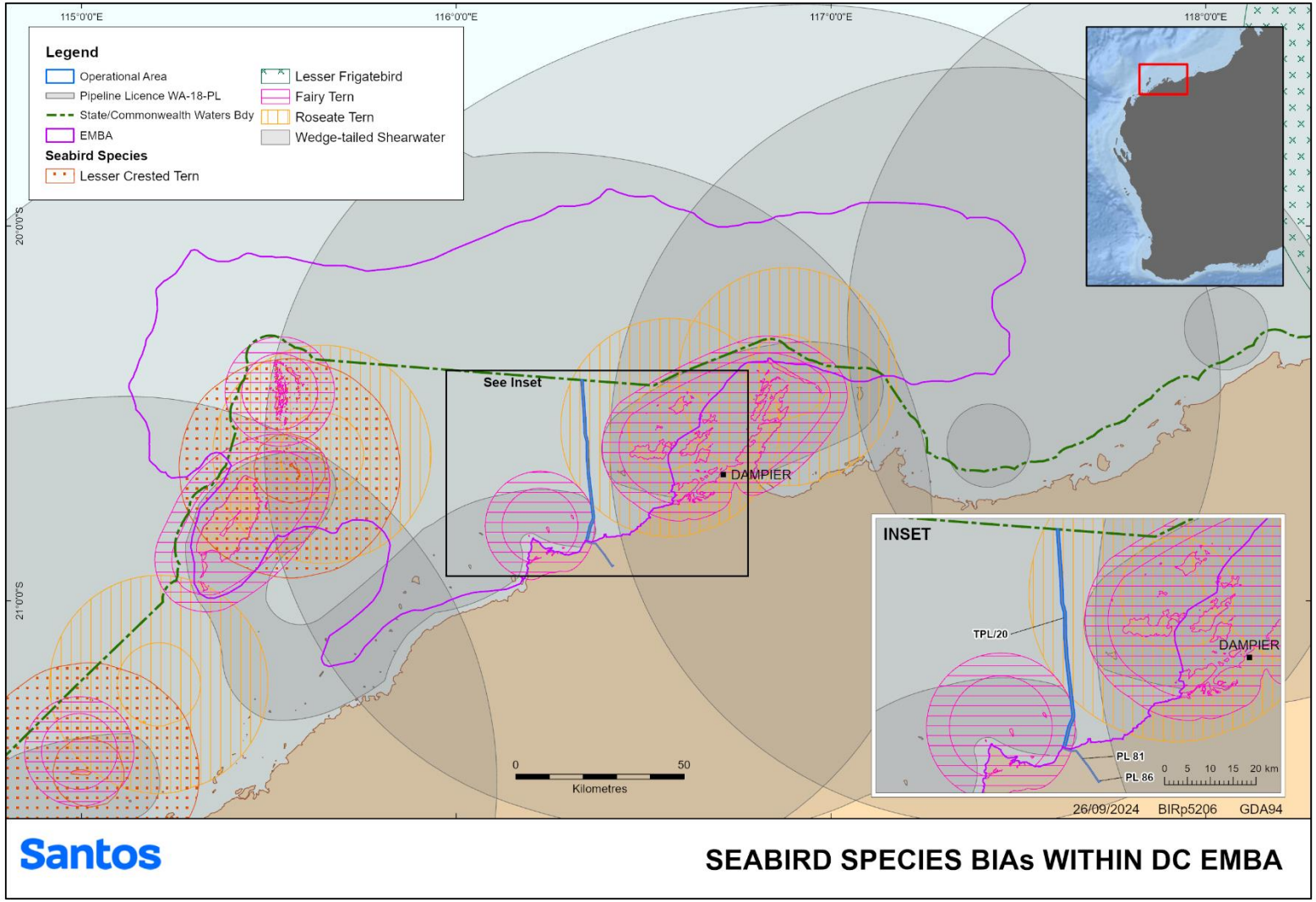


Figure 3-16: BIAs for seabird species in vicinity of Devil Creek operational area

3.2.7.3 Recovery plans

To support the protection of threatened and migratory species a series of recovery plans, conservation advice and species management plans have been developed by the Commonwealth of Australia. These documents identify threats to the specific species they are associated with and, in some cases, recommend conservation actions that should be undertaken to protect that species.

Table 3-11 summarises the recovery plans, conservation advice and species management plans relevant to the threatened and migratory species that have been identified as potentially occurring within the operational area, HEVA, MEVA and EMBA. Table 3-11 also identifies the actions within these documents that are relevant to the petroleum activity.

Table 3-11: Threats and strategies from recovery plans, conservation advice and management plans relevant to the activity

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
All Fauna				
All vertebrate fauna Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia,2018)	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia,2018)	Marine debris	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.	7.3, 7.4, 7.7
Marine Mammals				
Australian Snubfin Dolphin	Conservation Advice for Orcaella heinsohni (Australian snubfin dolphin) (2025)	Climate variability and change	Climate change (no specific actions relevant to this activity) · Understand impacts of climate variability and anthropogenic climate change on species biology and population recovery. Habitat loss (related to pollution) · Improve management systems designed to minimise the impact of coastal development/infrastructure on Australian snubfin dolphins, by ensuring that existing information about coastal habitat requirements, environmental suitability of coastal locations and areas of high use are available to coastal planning and approvals areas in all levels of government Anthropogenic noise (specific to policy development, but noise impacts considered in this EP) · Ensure behavioural impacts are considered when developing and updating policy documents on the	6.4
		Habitat loss and degradation – Marine pollution		6.7, 6.8, 6.9, 7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Anthropogenic underwater noise – Industrial noise		6.2,
		Anthropogenic underwater noise - Vessel noise		6.2,
		Vessel interactions -Vessel strike		7.2,

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
			management of inshore dolphins and underwater anthropogenic noise Vessel Strike · Ensure all vessel strike incidents are reported in the National Ship Strike Database. · Ensure the risk of vessel strike on Australian snubfin dolphins is considered when assessing actions that increase vessel traffic on areas Australian snubfin dolphins occur and, if required, appropriate mitigation measures are implemented	
Australian humpback dolphin	Conservation Advice for Sousa sahulensis (Australian humpback dolphin) (2025).	Climate variability and change	Climate change (no specific actions relevant to this activity) • Understand impacts of climate variability and anthropogenic climate change on species biology and population recovery. Habitat loss (related to pollution) • Improve management systems designed to minimise the impact of coastal development/infrastructure on Australian snubfin dolphins, by ensuring that existing information about coastal habitat requirements, environmental suitability of coastal locations and areas of high use are available to coastal planning and approvals areas in all levels of government Anthropogenic noise (specific to policy development, but noise impacts considered in this EP) • Ensure behavioural impacts are considered when developing and updating policy documents on the management of inshore dolphins and underwater anthropogenic noise Vessel Strike • Ensure all vessel strike incidents are reported in the National Ship Strike Database. Ensure the risk of vessel strike on Australian snubfin dolphins is considered when assessing actions that increase vessel traffic on areas Australian snubfin dolphins occur and, if required, appropriate mitigation measures are implemented	6.4
		Habitat loss and degradation – Marine pollution		6.7, 6.8, 6.9, 7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Vessel interactions -Vessel strike		7.2
		Anthropogenic underwater noise – Industrial noise		6.2,
		Anthropogenic underwater noise - Vessel noise		6.2,
Blue whale		Noise interference		6.2

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
	Blue Whale Conservation Management Plan 2015-2025 (2015) Guidance on key terms within the Blue Whale Conservation Management Plan (Department of Agriculture, Water, and the Environment, 2021) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Habitat modification	Assess and address anthropogenic noise: shipping, industrial and seismic noise. 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. • 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.	6.5, 7.3, 7.4, 7.5, 7.7, 7.8, 7.10, 7.11
		Climate variability and change		6.4
		Vessel disturbance		7.2
Fin whale	Approved Conservation Advice for Balaenoptera physalus (fin whale) (2015) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Anthropogenic noise and acoustic disturbance	Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development). 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 Vessel Strike Database. No explicit management measures for marine debris.	2, 6.3
		Climate variability and change		6.4
		Pollution (persistent toxic pollutants)		7.4, 7.7, 7.8, 7.10, 7.11
		Vessel strike		7.2
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (2015) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Anthropogenic noise and acoustic disturbance	Once the spatial and temporal distribution (including biologically important areas) of Sei Whales is further defined, assess the impacts of increasing anthropogenic noise (including seismic surveys, port expansion, and coastal development).	2, 6.3
		Climate variability and change		6.4
		Habitat degradation including pollution (persistent toxic pollutants)		6.5, 7.3, 7.4, 7.5, 7.7, 7.8, 7.10, 7.11
		Marine debris		7.3, 7.4, 7.7
		Vessel strike		7.2
Humpback whale	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Noise interference	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for	2
		Habitat degradation including coastal development and port expansion or drilling infrastructure		6.5, 7.4, 7.5, 7.7, 7.8, 7.10, 7.11

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
		Marine debris	example 'ghost' gear), and State and Commonwealth management through regulation.	7.3
		Vessel strike		7.2
Southern right whale	Conservation Management Plan for the Southern Right Whale 2011–2021 (2012)	Habitat modification	No explicit relevant management actions: entanglement in marine debris identified as a threat. Assess and address anthropogenic noise: shipping, industrial and seismic noise. Develop a national ship strike strategy that quantifies vessel movements within the distribution ranges of southern right whales and outlines appropriate mitigation measures that reduce impacts from vessel collisions.	7.3, 7.4, 7.7
		Noise interference		2
		Pollution		7.4, 7.7, 7.8, 7.10, 7.11
		Climate variability and change		6.4
		Vessel strike		7.2
	National Recovery Plan for Southern Right Whale (2024)	Anthropogenic climate change and climate variability	Understand impacts of climate variability and anthropogenic climate change on species biology and population recovery.	6.4
		Anthropogenic underwater noise	Assess manage and mitigate impacts from anthropogenic underwater noise	2
		Collision/vessel strike	Manage, minimise and mitigate threat of vessel strike	7.2
		Pollution	No explicit management actions	6.7, 6.8, 7.4, 7.7, 7.8, 7.10, 7.11
Marine Reptiles				
Short-nosed seasnake	Approved Conservation Advice on *Aipysurus apraefrontalis* (short-nosed seasnake) (2011)	Degradation of reef habitat	Monitor known populations to identify key threats. Ensure there is no anthropogenic disturbance in areas where the species occurs, excluding necessary actions to manage the conservation of the species.	6.5, 7.3, 7.4, 7.5, 7.7, 7.8, 7.10, 7.11
Leaf-scaled seasnake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (2011)	Habitat degradation	No explicit relevant management actions	6.5, 7.3, 7.4, 7.5, 7.7, 7.8, 7.10, 7.11
All marine turtles	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Light pollution	The aim of the Guidelines is that artificial light will be managed so wildlife is: • Not disrupted within, nor displaced from, important habitat • Able to undertake critical behaviours such as foraging, reproduction and dispersal. Best practice lighting design incorporates the following design principles:	6.3

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
			• 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 ultra-violet wavelengths.	
	Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017)	Marine debris	Reduce impacts from marine debris: • Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life.	7.3
		Vessel disturbance	Vessel interactions identifies as a threat; no specific management actions in relation to vessels prescribed in the plan.	2, 7.2
		Light pollution	Minimise light pollution: Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed 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.	6.3
Leatherback turtle, leathery turtle	Approved Conservation Advice on *Dermochelys coriacea* (2008)	Boat strike	Refer above to: • National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023) • Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017) • Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	7.2
		Changes to breeding sites		7.7, 7.8, 7.10, 7.11
		Marine debris		7.3, 7.4,

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
			• Key management actions identified in the conservation advice are in the Recovery Plan for Marine Turtles in Australia (2017) relevant to the Leatherback Turtle	
Fish and Sharks				
Whale shark	Approved Conservation Advice for Rhincodon typus (whale shark) (2015)	Marine debris	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 Western Australian coastline along the 200 m isobath (as set out in the Conservation Values Atlas, DoE, 2014). Implement measures to reduce adverse impacts of habitat degradation and/or modification.	7.3, 7.4, 7.7
		Habitat disruption from mineral exploration, production and transportation		7.3, 7.4, 7.7
		Climate change		6.4
		Boat strike from large vessel		7.2
Grey nurse shark (west coast population)	Recovery Plan for Grey Nurse Shark (Carcharias taurus) (2014)	Ecosystem effects as a result of habitat modification and pollution effects	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 through the application of advice in the marine bioregional plans on the types of actions which are likely to have a significant impact on the species and updating such conservation measures as new information becomes available.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Pollution and disease	Review and assess the potential threat of introduced species, pathogens and pollutants.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Ecosystem effects - climate change	No explicit relevant management actions: climate change identified as a threat.	6.4
	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Marine debris	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.	7.3, 7.4, 7.7
Great white shark	Recovery Plan White Shark (Carcharodon carcharias) (2013)	Ecosystem effects as a result of habitat modification	No explicit relevant management actions: habitat modification and climate identified as a threat	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Dwarf sawfish	Approved Conservation Advice on Pristis clavata (dwarf sawfish) (2009)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
	Sawfish and River Sharks Multispecies Recovery Plan (2015)			
Green sawfish	Approved Conservation Advice on Pristis zijsron (green sawfish) (2008)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
	Sawfish and River Sharks Multispecies Recovery Plan (2015)			
Freshwater sawfish	Approved Conservation Advice for *Prestis prestis* (largetooth sawfish) (2014)	Habitat degradation and modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
	Sawfish and River Sharks Multispecies Recovery Plan (2015)			
Blind Cave-Eel	Approved Conservation Advice for Ophisternon candidum (Blind Cave Eel) (2008)	Sedimentation from mining and construction, canal development, water abstraction, point source pollution from sewage, landfill, dumping and mining; and diffuse pollution from urban development.	No explicit management actions that relate to the activity	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Birds				
All seabirds and shorebirds	National Light Pollution Guidelines for Wildlife (DCCEEW 2023)	Habitat modification	The aim of the Guidelines is that artificial light will be managed so wildlife is: • Not disrupted within, nor displaced from, important habitat • Able to undertake critical behaviours such as foraging, reproduction and dispersal. Best practice lighting design incorporates the following 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.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Climate change and variability		6.4
		Light pollution		6.3

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
			• Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.	
Seabirds	Wildlife Conservation Plan for Seabirds (CoA 2020)	Anthropogenic disturbance	No explicit relevant management actions	7.3, 7.4, 7.7
		Climate change		6.4
		Invasive species		7.1
		Pollution (marine debris, light, water)		7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Habitat loss or modification		7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Sharp-tailed Sandpiper	Conservation advice for Calidris acuminata (sharp-tailed sandpiper) (DCCEEW 2024b) Wildlife Conservation Plan for Migratory Shorebirds (CoA 2015)	Climate change	No explicit relevant management actions: oil pollution recognised as a threat.	6.4
		Chronic and acute pollution		7.3 7.4, 7.7, 7.8, 7.10, 7.11
Red knot	Approved Conservation Advice for Calidris canutus (red knot) (2024) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation	No explicit relevant management actions: oil pollution recognised as a threat.	7.3 7.4, 7.7, 7.8, 7.10, 7.11
		Climate change		6.4
		Pollution/contamination impacts		7.4, 7.7, 7.8, 7.10, 7.11
Southern giant-petrel	National Recovery Plan for Albatrosses and Petrels (2022) Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened Under the EPBC Act (2011)	Marine pollution	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7
		Climate change		6.4
		Marine debris		7.3
Curlew sandpiper	Approved Conservation Advice for Calidris ferruginea (curlew sandpiper) (2023)	Habitat loss and degradation from pollution	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Greater sand plover	Approved Advice for Charadrius leschenaultia (greater sand plover) (2023) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Climate variability and change		6.4
		Pollutant/contaminant impacts		7.4,7.7,7.8,7.9, 7.10, 7.11
Red goshawk	Conservation Advice for Erythrotriorchis radiatus (red goshawk) (2023)	Climate variability and change	No explicit relevant management actions	6.4
Eastern curlew	Approved Conservation Advice for Numenius madagascariensis (eastern curlew) (2023)	Habitat loss and degradation from pollution	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity	Relevant Conservation Actions	Addressed in EP Section
Bar-tailed godwit	Approved Conservation Advice for Limosa lapponica baueri (bar-tailed godwit western Alaskan) (2024) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation from pollution	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Pollution/contamination impacts		7.4,7.7,7.8, 7.9, 7.10, 7.11
Northern Siberian bar-tailed godwit	Approved Conservation Advice for Limosa lapponica menzbieri (bar-tailed godwit northern Siberian) (2024)	Habitat loss and degradation from pollution	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Pollution/contamination impacts		7.4,7.7,7.8, 7.9, 7.10, 7.11
Australian fairy tern	Commonwealth Conservation Advice on Sternula nereis nereis (fairy tern) (2011) National Recovery Plan for the Australian Fairy Tern (Sternula nereis nereis) (2020)	Oil spills	No explicit relevant management actions: oil pollution recognised as a threat.	7.7
		Habitat loss, disturbance and modifications		7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Climate variability and change		6.4
White-winged fairy wren	Approved Conservation Advice for Malurus leucopterus edouardi (white-winged fairy-wren (Barrow Island))	Habitat loss, disturbance and modification	No explicit relevant management actions that relate to the activity	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Night parrot	Conservation Advice Pezoporus occidentalis night parrot (2016)	Habitat loss, disturbance and modification	No explicit relevant management actions that relate to the activity	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Red-tailed tropicbird	Conservation Advice for Phaethon rubricauda westralis (Indian Ocean red-tailed tropicbird).(2023) Wildlife Conservation Plan for Migratory Seabirds (2020)	Climate variability and change	No explicit relevant management actions that relate to the activity	6.4
Australian painted snipe	Commonwealth Conservation Advice for Rostratula australis (Australian painted snipe) (2013) National Recovery Plan for the Australian Painted Snipe (Rostratula australis) (2022a)	Habitat loss, disturbance and modification	No explicit relevant management actions: oil pollution recognised as a threat.	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
Little Tern	Conservation Advice for Sternula albifrons (little tern).	Climate variability and change	No explicit relevant management actions that relate to the activity	7.3, 7.4, 7.7, 7.8, 7.10, 7.11
		Human disturbance onshore		

3.2.8 Socio-economic

Socio-economic activities that may occur within the operational area and surrounds include (but is not limited to) commercial fishing, oil and gas exploration and production and, to a lesser extent, recreational fishing and tourism as summarised below. More detailed descriptions of socio-economic consideration are provided in Appendix C.

3.2.8.1 Commercial fisheries

Offshore and coastal waters in the North-west Marine Region support a valuable and diverse commercial fishing industry. The major fisheries in the Pilbara region target tropical finfish, large pelagic fish, crustaceans (prawns and scampi) and pearl oysters (Newman et al.,2023).

These NWS region fisheries are managed by either the Department of Primary Industries and Regional Development (DPIRD) (State fisheries) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the *Fish Resources Management Act 1994*; or by Australian Fisheries Management Authority (AFMA) who manages Commonwealth fisheries (within the 200 nautical mile Australian Fishing Zone).

Commonwealth and State fisheries overlapping with the operational area and the EMBA are illustrated in Figure 3-17, Figure 3-18 and Figure 3-19. Table 3-12 describes each of these fisheries and indicates which events associated with the activity may impact on these.

Previous consultation with DPIRD has identified commercial fishing interests that exist in, or in close proximity to, proposed activities under this EP. Further, Santos continually updates its understanding of the fisheries through reviews of annual status of the fishery reports published by DPIRD and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), other relevant fisheries management publications, and fishery catch and effort data.

Table 3-12: State and Commonwealth commercial fisheries in the vicinity of the operational area and the EMBA

Fishery	Fishery Licence Area Overlap				Description	Relevant Events within the operational area
	Operational area Presence	MEVA CSB Presence	MEVA HDD Presence	EMBA Presence		
Commonwealth Managed Fisheries						
Southern Bluefin Tuna Fishery	✓	✓	✓	✓	Since 1992 juvenile Southern Bluefin Tuna have been targeted in the Great Australian Bight and waters off South Australia. The Southern Bluefin Tuna Fishery is only active in waters offshore south and south-eastern Australia, as confirmed in consultation with the Australia Southern Bluefin Tuna Association in consultation for previous company offshore activities, also illustrated in the ABARES Fishery Status Reports, 2023.	No active commercial fishing within the operational area in the past few years; however, fisheries overlap the EMBA, and therefore fishing vessels could be encountered in low density.
Western Tuna and Billfish Fishery	✓	✓	✓	✓	Extends westward from Cape York Peninsula (142°30' E) off Queensland to 34° S off the Western Australian west coast. It also extends eastward from 34° S off the west coast of Western Australia across the Great Australian Bight to 141° E at the South Australia–Victoria border. Since 2005, there have been fewer than five vessels active in the Western Tuna and Billfish Fishery each year, which has reportedly declined from 50 active vessels in 2000 (ABARES Fishery Status Reports, 2023). In recent years fishing activity in the Western Tuna and Billfish Fishery has been concentrated in waters off south-west Western Australia, with occasional activity off South Australia (ABARES Fishery Status Reports, 2023).	
Western Skipjack Tuna Fishery	✓	✓	✓	✓	There has been no fishing effort in the Skipjack Tuna Fishery since the 2009 season, during which activity concentrated off South Australia (ABARES Fishery Status Reports, 2023). No current effort on the NWS.	
State Managed Fisheries (North Coast Bioregion)						
Pearl Oyster Managed Fishery	✓	✓	✓	✓	Mostly operates March to June. Operates in shallow coastal waters along the north cast bioregion, Effort in the operational area is unlikely due to the depth and the dive-based method of collection.	The operational area for this activity does intersect the Pearl Oyster Managed Fishery. No activity from this fishery has been recorded within the operational area.

Fishery	Fishery Licence Area Overlap				Description	Relevant Events within the operational area
	Operational area Presence	MEVA CSB Presence	MEVA HDD Presence	EMBA Presence		
Onslow Prawn Limited Entry Fishery	✓			✓	The boundaries of the Onslow Prawn Managed Fishery are 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay Prawn Fishery east of 114º39.9', on the landward side of the 200 m depth isobath'. There has been no record of any fishing effort from this fishery in the operational area.	The operational area for this activity does intersect the Onslow Prawn Managed Fishery. No activity from this fishery has been recorded within the operational area.
Mackerel Managed Fishery (Area 2)	✓	✓	✓	✓	Surface trolling or handline. Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands.	The operational area for this activity does intersect the Mackerel Managed Fishery Area 2. Low level of activity was recorded in the FishCube data blocks (2013-2023) that overlap the operational area within the last ten years. Data indicates that the fishery had catch effort recorded and a vessel count of four vessels or less within the operational area. The bulk of the total catch is taken in the Kimberley area.
Pilbara Demersal Scalefish Fisheries (includes trap and trawl fisheries)	✓			✓	These fisheries use a combination of vessels, effort allocations (time), gear limits, plus spatial zones (including extensive trawl closures) as management measures. The Trawl Fishery lands the largest component of the catch of demersal finfish in the Pilbara (and North Coast Bioregion) comprising more than 50 scalefish species. In comparison, the Trap Fishery retains a subset of about 45 to 50 scalefish species.	The operational area intersects the Trap Fishery (areas open and closed to traps) and a prohibited fishing area for the Trawl Fishery. No trap or trawl fishing activity has been recorded in the operational area.
Pilbara Line Fishery	✓	✓	✓	✓	The Pilbara Line Fishery fishing boat licensees are permitted to operate anywhere within 'Pilbara waters', bounded by a line commencing at the intersection of 21° 56' S latitude and the high water mark on the western side of the North West Cape on the mainland of Western Australia west along the parallel to the intersection of 21° 56' S latitude and the boundary of the Australian Fishing Zone and north to longitude 120° E.	The operational area for this activity does intersect the Pilbara Line Fishery. No activity from this fishery has been recorded within the operational area.

Fishery	Fishery Licence Area Overlap				Description	Relevant Events within the operational area
	Operational area Presence	MEVA CSB Presence	MEVA HDD Presence	EMBA Presence		
Pilbara Crab Managed Fishery	✓	x	x	✓	The boundaries of this fishery include waters between 114°39.9' E and 120° E, and on the landward side of the 200 m depth isobath.	Crabbing activity along the Pilbara coast is centred largely on the inshore waters from Onslow through to Port Hedland, with most commercial and recreational activity occurring in and around Nickol Bay (Johnston et al.,2023). No activity from this fishery has been recorded within the operational area.
Nickol Bay Prawn Managed Fishery	x	x	x	✓	Primarily targets banana prawns using otter trawl methods along the western part of the NWS in coastal shallow waters.	N/A
State Managed Fisheries (Whole of State)						
Marine Aquarium Fish Fishery	✓			✓	The Marine Aquarium Fish Fishery license area extends into Commonwealth waters, spanning the coastline from the Northern Territory border to the South Australia border. Operators may fish year-round below the high tide water mark on the landward side of the 200 m isobath. The fishery is most active in waters from Esperance to Broome, with popular areas being around the Capes, Perth, Geraldton, Exmouth and Dampier. Effort in the operational area is unlikely due to the depth and the dive-based method of collection. Unlikely to occur.	FishCube data (2013-2023) indicates that the Marine Aquarium Managed Fishery had catch effort recorded and up to nine licences within the operational area. FishCube data (2013-2023) identified that the Specimen Shell Managed Fishery had catch effort recorded and three or less licences within the operational area.
Specimen Shell Managed Fishery	✓	✓	✓	✓	The Specimen Shell Managed Fishery spans the entire Western Australian coastline, with efforts concentrated in areas adjacent to population centres such as Broome, Exmouth, Perth, Mandurah, the Capes area and Albany. The main harvesting methods are by hand by divers operating from small vessels in shallow coastal waters or by wading along coastal beaches below the high-water mark.	
West Coast Deep Sea Crustacean Managed Fishery	✓	✓	✓	✓	Baited pots targeting crabs. This fishery extends seaward from the 150 m isobath, north of Augusta to the Northern Territory border, which is outside the operational area but within the EMBA. Catch effort is concentrated in areas south of Exmouth; therefore, it will not interact with planned and unplanned events for this activity.	Disruption to this fishery will not result from planned or unplanned events. No activity from this fishery has been recorded within the operational area.

Fishery	Fishery Licence Area Overlap				Description	Relevant Events within the operational area
	Operational area Presence	MEVA CSB Presence	MEVA HDD Presence	EMBA Presence		
South West Coast Salmon Fishery	✓	✓	✓	✓	Although permitted to fish within the operational area and the EMBA, the fishery is biogeographically limited to the southwest coast.	
Abalone Managed Fishery	✓	x	✓	✓	The commercial fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks.	No activity from this fishery has been recorded within the operational area. Unplanned events that may occur in the EMBA are also unlikely to disrupt fishing activities.
West Australian Sea Cucumber Fishery	✓	x	✓	✓	Fishing occurs in the northern half of the State from Exmouth Gulf to the Northern Territory border. Effort in the operational area is unlikely due to the depth and the dive-based method of collection.	Operational area does occur within the boundaries of the fishery. FishCube (2013-2023) reports that the fishery had catch effort and less than three vessels in the operational area.
Hermit Crab Fishery	✓	x	✓	✓	Operates in Western Australian waters north of the Exmouth Gulf (22°30'S). Land based hand collection of Australian land hermit crab (*Coenobita variabilis)* typically using four-wheel drives to access remote beaches.	FishCube data for 2013–2023 indicates that for the hermit crab fishery the fishery has been active with less than three licences within the operational area. Disruption is unlikely to occur in the operational area due to land based collection by hand.

3.2.8.2 Recreational fisheries

Recreational fisheries are managed by the WA Department of Fisheries (DoF) and the area covered in this EP falls within the North Coast Bioregion. Within the North Coast Bioregion, recreational fishing is experiencing significant growth, with a distinct seasonal peak in winter when the local population increases significantly in Onslow and Dampier Archipelago regions (DoF, 2006). Creek systems, mangroves and rivers, and ocean beaches provide shore and small boat fishing for a variety of species, including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin, mud crabs and cods. Offshore islands, coral reefs and continental shelf provide species of major recreational interest including saddletail snapper, red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish.

In the vicinity of the DC supply pipeline, recreational fishers have access to the area via Forty Mile Beach with vehicle access to the beach, camp sites and an intertidal boat access facility. It is utilised as a recreational camping and fishing area by locals and tourists, particularly during the winter months. Seasonal camping at Forty Mile Beach between May and September is managed by the Shire of Roebourne.

Recreational fishing does occur within the EMBA, and therefore could be impacted by a loss of well control.

3.2.8.3 Petroleum industry

To the northeast of the DCGP, approximately 30 km along the North West Coastal Highway, is a mini liquefied natural gas processing plant operated by Energy Development Limited (Figure 3-20). Cape Preston, located approximately 20 km northwest of the DCGP, is also the proposed site for several mining and industrial developments.

The surrounding waters are also used extensively for petroleum exploration and development. The DC supply pipelines passes approximately 29 km to the north of the Stag Production Facility operated by Jadestone Energy. In addition, Wandoo Production Platforms are located in Exploration Permit WA-14-L, within the region.

3.2.8.4 Shipping

The DC supply pipeline resides between two shipping fairways (Australian Maritime Safety Authority (AMSA), 2013a). The first runs parallel to the DC supply pipeline approximately 20 km to the east. The other crosses the DC supply pipeline at approximately 57 km from the MLWM and runs in a south-west to north-east direction. Additional shipping routes are located within the wider region and it is expected that local vessel traffic will pass through the area. Shipping fairways for the NWS are illustrated in Figure 3-21.

3.2.8.5 Defence

A Defence training Area (RAAF Base Learmonth) overlaps with EMBA. Designated military exercise areas occur over waters and airspace of the EMBA and may be activated following the required notifications. The defence training area is shown in Figure 3-22.

3.2.8.6 Tourism

A number of tourism activities are known to occur within the operational area and EMBA. These are primarily associated with the, Montebello AMP and Dampier AMP. Specific tourism activities in these areas include recreational diving, snorkelling and cruises.

The area also attracts recreational fishing activities, these are described above.

3.2.8.7 Cultural features

Introduction

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.

The cultural heritage of First Nations peoples includes a vast array of tangible and intangible 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), Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth) (ATSIHP Act), Underwater Cultural Heritage Act 2018(Cth) (UCH Act).

Country is an important concept to First Nations people and the term is often to describe family origins and associations with particular parts of Australia, both land and sea (Smyth, 2007). The expressions Country and Sea

Country are used to refer to the land and waters which constitute Aboriginal traditional areas as ancestrally distinct and linguistically bounded geographic areas (Kearney et al, 2023 p106).

Country is inclusive of many environments that are ecologically, geographically, ancestrally and socially configured (Kearney et al 2023). For First Nations Indigenous People, Country is a combination of the land, sea, rivers and islands and all that they contain and sustain. “Country refers to more than just a geographical area: it is shorthand for all the values, places, resources, stories and cultural obligations associated with that geographical area.” (Smyth, 2007).

First Nations people in northwest WA continue to rely on coastal and marine environments and resources of the region for their cultural identity, health and wellbeing, and their domestic and commercial economies (Smyth, 2007).

Numerous different Indigenous groups have connections to different parts of Country. These family groups are representative of many different Indigenous language groups.

Submerged archaeological landscapes have recently been identified in WA through combined evidence of terrestrial ecology, coastal and marine geomorphology and sea-level studies (Benjamin et al 2020; McCarthy et al 2022). There is a potential for the existence of submerged landscapes with associated Aboriginal heritage values due to strong cultural connections between Traditional Owners and the sea (McCarthy et al 2022).

Sea country

The Australian Marine Parks North-west Marine Parks Network Management Plan 2018 defines sea country as “the areas of the sea that Aboriginal and Torres Strait Islander groups are particularly affiliated with through their traditional lore and customs”. Sea country is valued for Aboriginal cultural identity, health and wellbeing. Aboriginal people of north-western Australia have been sustainably using and managing their sea country for tens of thousands of years, in some cases since before rising sea levels created these marine environments (DNP, 2018).

A common feature of coastal Aboriginal cultures is the connectedness of land and sea: together they form a country of significant cultural sites and dreaming tracks of the creation ancestors (NOO, 2002). As a result, coastal environments are an integrated cultural landscape/seascape that is conceptually different from the broader Australian view of land and sea (NOO, 2002).

Animals can be totems for Aboriginal people. Aboriginal people share the land and water with animals and their relationship with totem animals is fundamental to continued practice and cultural responsibility; for food, health, shelter, cultural expression and spiritual wellbeing (VAHC, 2021). Caring for plants, animals and their habitats is therefore seen as a key way of expressing culture (VAHC, 2021).

It is recognised that spiritual corridors extend from terrestrial areas into nearshore and offshore waters, that a number of marine animals are totems for Indigenous people.

Aboriginal people use and actively manage the coastal and marine environments as a resource and to maintain cultural identity, health and wellbeing. Fishing, hunting and the maintenance of culture and heritage through ritual, stories and traditional knowledge continue as important uses of nearshore and adjacent areas.

Sea country is described in both State, Territory and Commonwealth Marine Park Management Plans. The Australian Marine Park Management Plans include the objective to provide for the protection and conservation of biodiversity and other natural, cultural and heritage values of marine parks. The plans define cultural values as “living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites” (DNP, 2018). Australian Marine Park Management Plans list the Aboriginal people who have responsibilities for sea country in the Marine Parks, and the Native Title Representative Body for the region.

The PMST Report determined the EMBA for this EP overlaps the North-west Marine Park network which is managed by the North-west Marine Parks Network Management Plan. The following information is considered correct at the time of writing from the North-West Marine Parks Network Management Plan 2018 (DNP, 2018).

Montebello Marine Park

At the commencement of this plan there was limited information on the cultural significance of this Marine Park. The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara region.

Dampier Marine Park

The Ngarluma, Yindjibarndi, Yaburara and Mardudhunera people have responsibilities for sea country in the Marine Park. The native title holders for these people are represented by the Ngarluma Aboriginal Corporation and Yindjibarndi Aboriginal Corporation. There Prescribed Body Corporates represent traditional owners with native title coastal areas adjacent to the Marine Park are the points of contact for the respective areas of responsibility for sea country in the Marine Park.

The Yamatji Marlpa Aboriginal Corporation (YMAC) is the Native Title Representative Body for the Pilbara and Yamatji regions.

These people/groups have been consulted, in some cases via representative prescribed body corporates as outlined in Section 4.

Indigenous Land use Agreements

An "Indigenous land use agreement" (ILUA) is a voluntary, legally binding agreement about the use and management of land or waters, made between one or more native title groups and non-native title interest holders in the ILUA area (such as grantee parties, pastoralists or governments).

The Register of Indigenous Land Use Agreements is kept by the Native Title Registrar in accordance with s199A of the NTA and includes a description of the ILUA area, the parties' names, the term of the ILUA and other information as the Registrar considers is appropriate (s199B of the NTA).

Registration confers a contractual effect on the ILUA and binds all persons holding native title regardless as to whether they are already parties to the ILUA (s24EA of the NTA).

A search of the Native Title Register found the following ILUAs within the EMBA:

- Kuruma Marthudunera and Yaburara and Coastal Mardudhunera Indigenous Land Use Agreement- Area Agreement
- Cape Preston Project Deed (YM Mardie) Indigenous Land Use Agreement- Area Agreement
- RTIO Ngarluma Indigenous Land Use Agreement-Body Corporate Agreement)

Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are areas of land and sea that Traditional Owners have agreed to manage for biodiversity conservation. IPAs represent more than 50% of National Reserve System.

The Sea Country Indigenous Protected Areas (IPA) Program seeks to increase the area of sea in IPAs to strengthen the conservation and protection of Australia's unique marine and coastal environments, while creating employment and economic opportunities for Indigenous Australians.

A search of the Native Title Register identified no IPAs within the operational area or EMBA.

Aboriginal Cultural Heritage Inquiry System

The Department of Planning, Lands and Heritage (DPLH) Aboriginal Cultural Heritage Inquiry System (ACHIS) provides information about Aboriginal sites (as defined under the Aboriginal Heritage Act 1972 (WA)) in Western Australia. To identify Aboriginal sites that may be affected by the Activities, a search of the ACHIS (undertaken April 2025, DPLH, 2025) (Appendix E) indicated there are:

- 1 registered Aboriginal site within the operational area. This was located at Devil Creek, Mardie Station and is a culturally sensitive site for engravings, grinding/ groove areas.
- 55 registered Aboriginal sites within the EMBA, mainly located on Enderby and Rosemary Islands.

While sea country is a recognised value, the registered site list is land-based sites, therefore could be impacted by shoreline accumulation of unplanned hydrocarbon releases.

3.2.9 Windows of sensitivity

Timing of peak activity for threatened and migratory species and other relevant, significant sensitivities is given in Table 3-13.

Table 3-13: Windows of sensitivity in vicinity of EMBA

Receptors (critical life cycle stages)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All shoreline habitats												
Coral (spawning periods)												
Macroalgae	growing				shedding fronds				growing			
Other benthic and terrestrial habitats												
Fish/Sharks and fisheries species												
Whale sharks			Aggregations at Ningaloo Coast									
Fisheries species spawning/aggregation times [1]												

Receptors (critical life cycle stages)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Marine Mammals												
Dugong (breeding)	breeding								breeding			
Humpback whale (migration)						northern			southern			
Blue whale (migration)					northern						southern	
Sei whales (migration)				Low density, same general pattern of migration as most other baleen whales								
Southern right whale (migration)					northern				southern			
Marine Reptiles												
Hawksbill turtle resident adult and juveniles[2]	Widespread throughout NWS waters, highest density of adults and juveniles over hard bottom habitat (coral reef, rocky reef, pipelines, etc.)											
Hawksbill turtle (mating aggregations[2])												
Hawksbill turtle (nesting and internesting[2])												
Hawksbill turtle (hatching[1])												
Flatback turtles (resident adult and juveniles[2])	Widespread throughout NWS waters, increased density over soft bottom habitat 10–60m deep, post hatchling age classes and juveniles spread across shelf waters											
Flatback turtle (mating aggregations[2])												
Flatback turtle (nesting and internesting[2])												
Flatback turtle (hatching[2])												
Flatback turtle (nesting[2])												
Green turtles (resident adult and juveniles[2])	Widespread throughout the NWS waters, highest density associated with seagrass beds and macro algae communities, high density juveniles in shallow waters off beaches, amongst mangroves and in creeks											
Green turtle (mating aggregations[2])												
Green turtle nesting and internesting[2])												
Green turtle (hatching[2])												
Loggerhead turtles (resident adult and juveniles[2])	Widespread throughout the NWS waters, increased density associated with soft bottom habitat supporting their bivalve food source, juveniles associated with nearshore reef habitat											
Loggerhead turtle (mating aggregations[2])												
Loggerhead turtle (nesting and internesting[2])												
Loggerhead turtle (hatching[2])												
Leatherback turtles	Can occur at low density across the NWS year-round											
Olive Ridley turtles	Can occur at low density across the NWS year-round											
Short-nosed seasnake	Can occur at low density across the NWS year-round											
Seabirds												
Terns, shearwaters, petrels (nesting)												
Commercial Managed Fisheries												
Oil and gas												

Receptors (critical life cycle stages)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Shipping												
Tourism/ recreational												

Key / notes		
	Peak activity, presence reliable and predictable	[1] Information provided from Department of Fisheries consultation
	Lower level of abundance/activity/presence	[2] Information provided by K. Pendoley
	Very low activity/presence	
	Activity can occur throughout year	
	Proposed timing of activity	

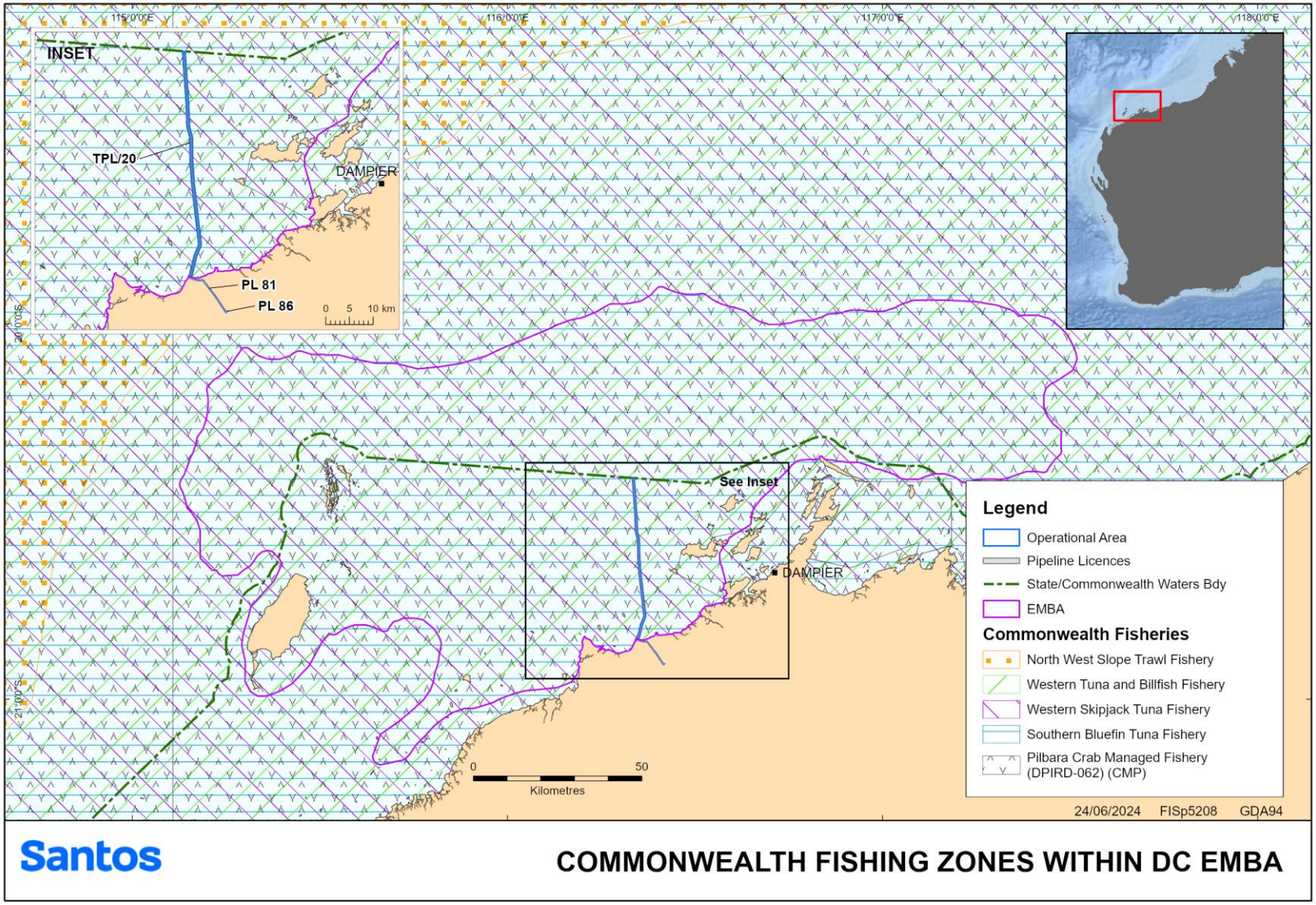


Figure 3-17: Commonwealth fishing zones within DC EMBA

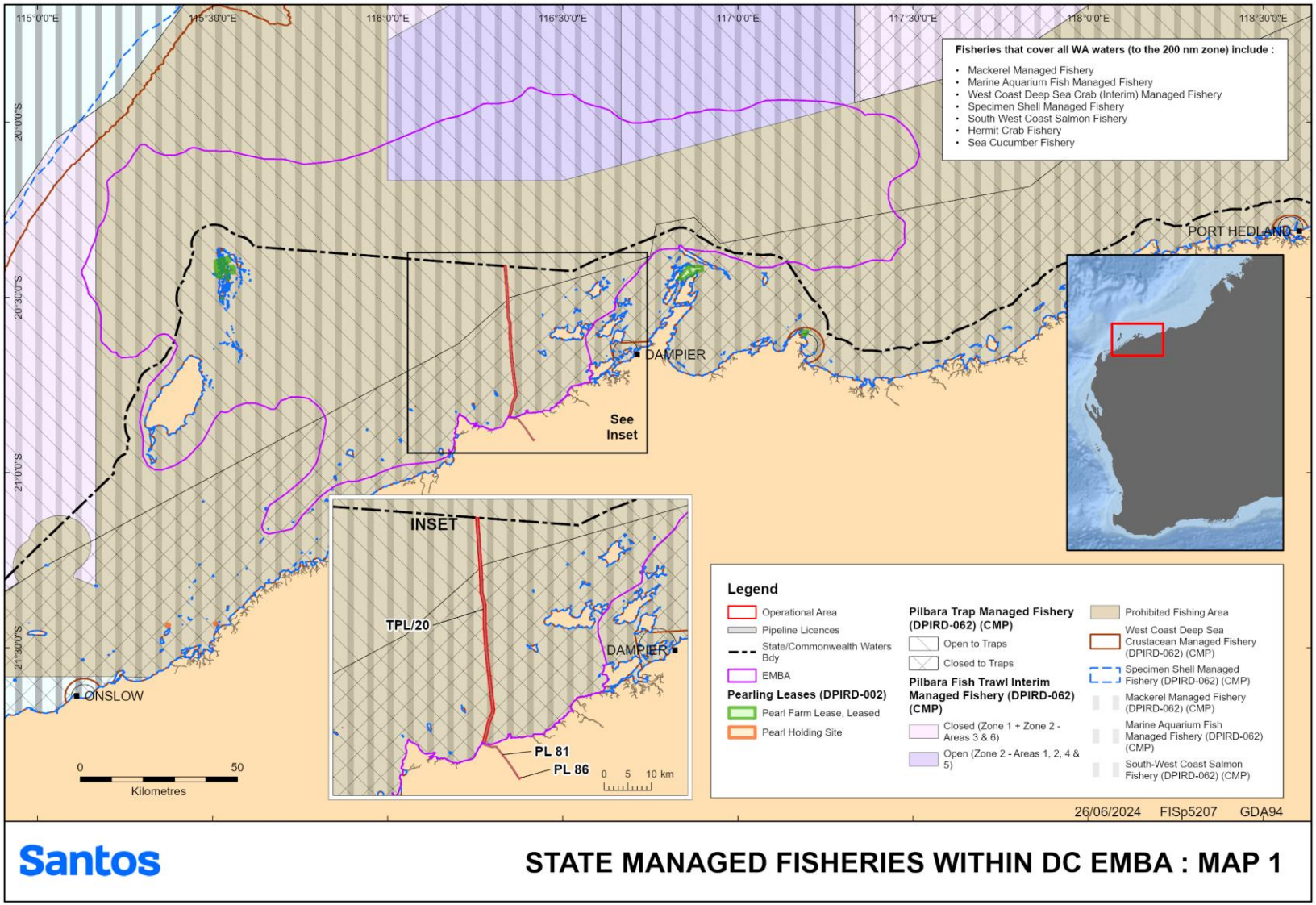


Figure 3-18: State managed fisheries within DC EMBA: Map 1

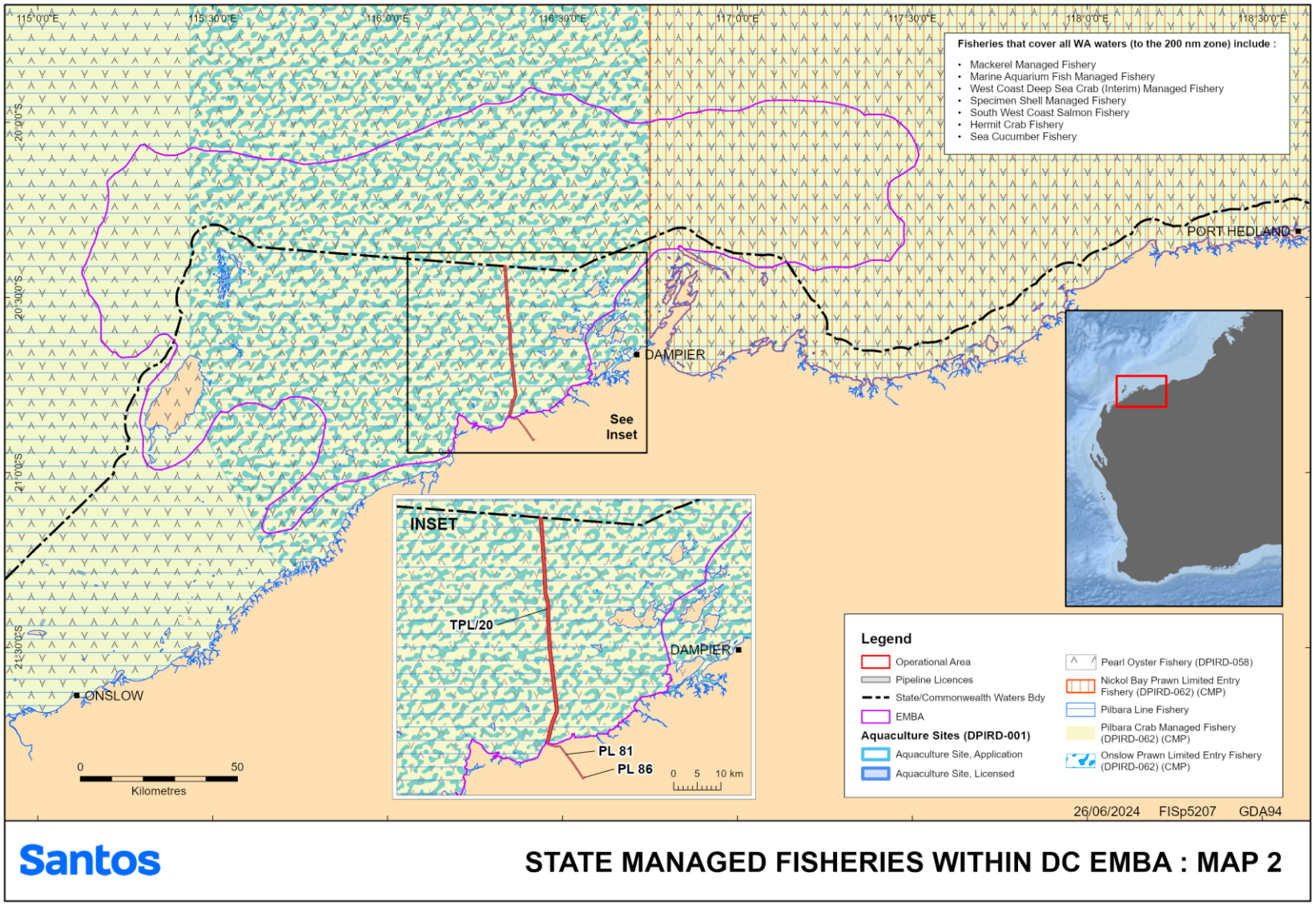


Figure 3-19: State managed fisheries within DC EMBA: Map 2

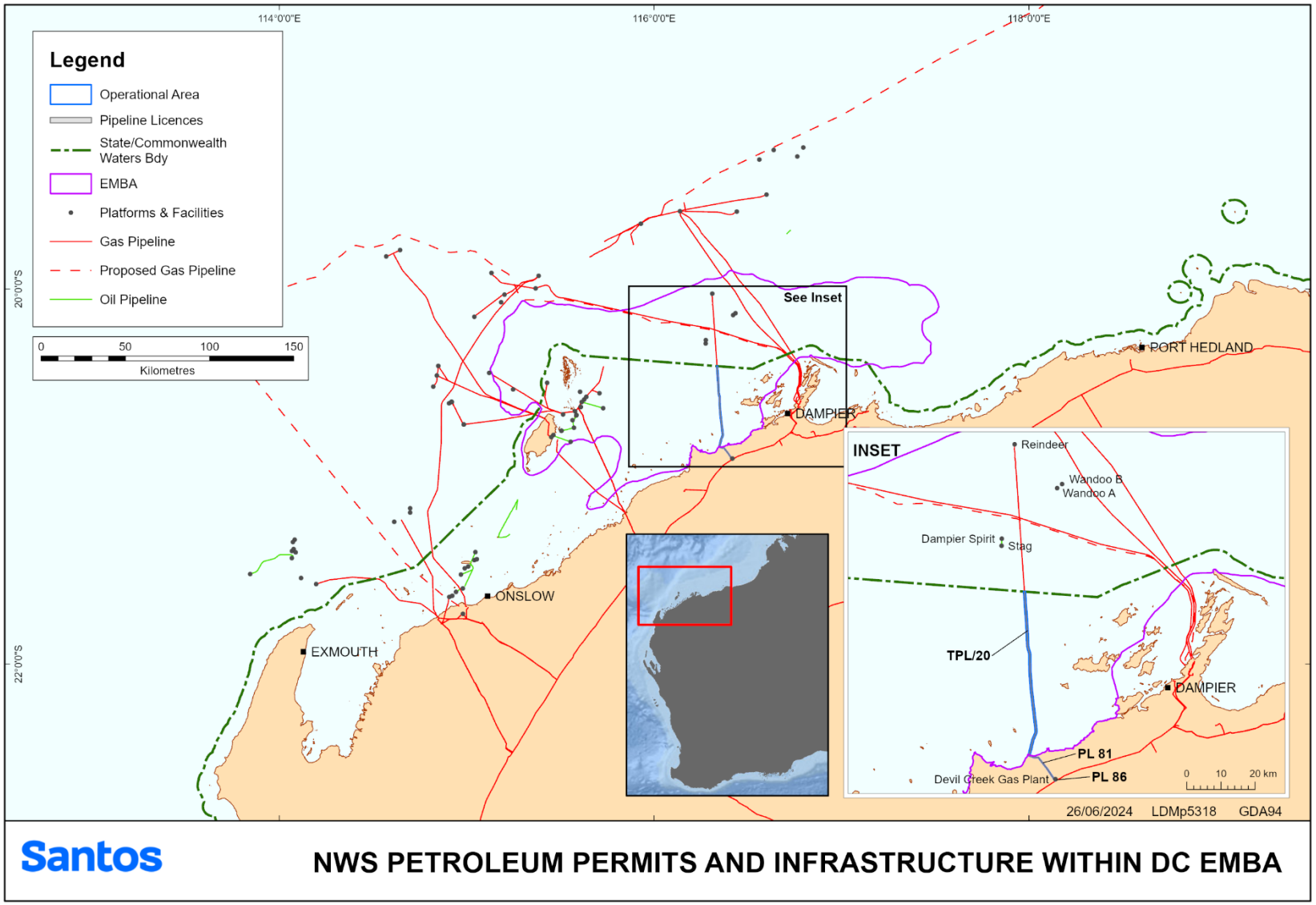


Figure 3-20: NWS petroleum permits and infrastructure within DC EMBA

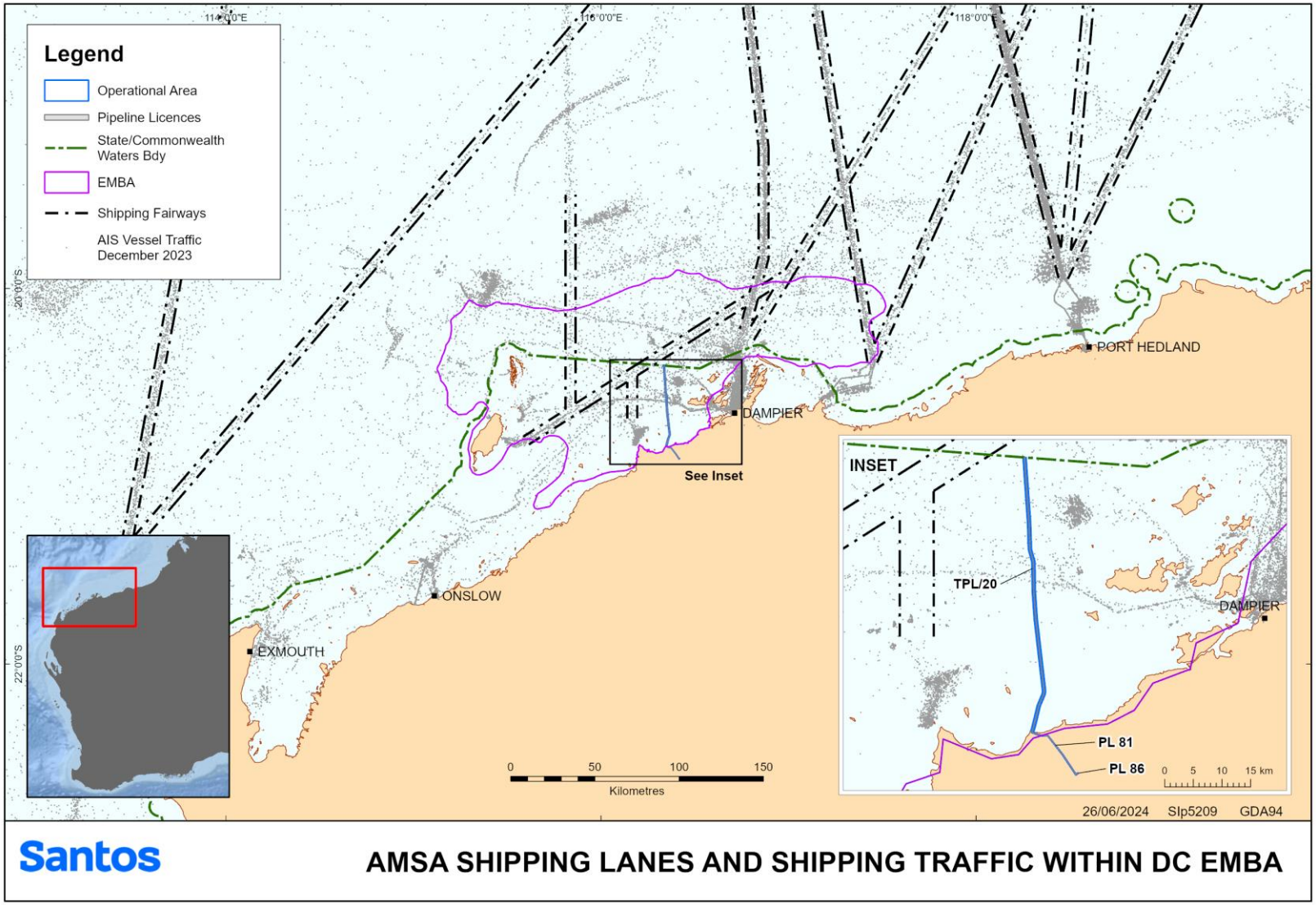


Figure 3-21: NWS shipping lanes and traffic data within DC EMBA

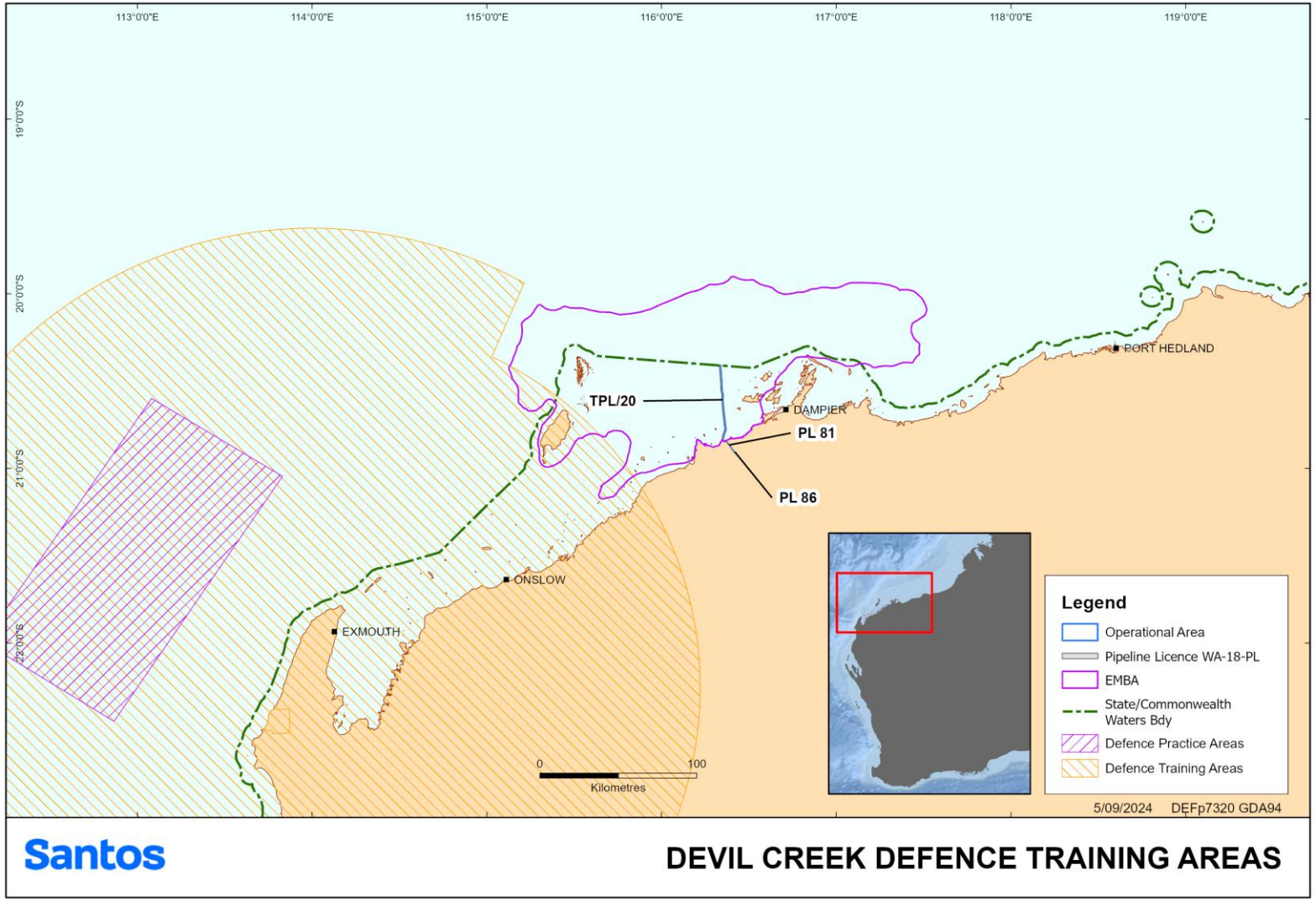


Figure 3-22: Defence areas within the DC EMBA

4. Stakeholder consultation

P(SL)(E)R 2012
Regulation 17(1)
The environment plan must include the following: b) a report on all consultations between the operator and relevant authorities and other relevant interested persons and organisations in the course of developing the environment plan.

4.1 Consultation background

Consultation with relevant authorities and other relevant interested persons and organisations (relevant persons) for proposed activities to be managed under this EP commenced in May 2024.

Santos' consultation methodology for this EP is outlined in Section 4.3, with consultation activities undertaken in two phases:

- Preliminary consultation (30 May – 28 June 2024). This included:
  - activities to allow authorities, persons and organisations opportunities to self-identify as relevant persons
  - engagement with potential relevant persons to confirm consultation expectations. Potential relevant persons that did not provide any feedback during preliminary consultation were carried into the consultation phase.
- Consultation (28 June – 29 July 2024). Activity-based consultation activities seeking feedback from relevant persons to inform development of this EP.

Santos undertook consultation with some authorities, persons and organisations outside of these consultation phases given existing relationships, consultation preferences and standing meeting and consultation arrangements.

A summary report of the consultation is included in Santos' post EP acceptance consultation implementation strategy for the Activities outlined in this EP is described in Section 8.17 and Activity notifications are outlined in Section 8.12.

4.2 Government and industry guidance

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

- *Guideline for the Development of Petroleum, Geothermal and Pipeline Environment Plans in Western Australia*

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

International Standards Organisation

- *ISO14001:2015 Environmental Management Systems*

Australian Fisheries Management Authority

- *Petroleum industry consultation with the commercial fishing industry*

Australian Heritage Commission

- *Ask First - A guide to respecting Indigenous heritage places and values*

Commonwealth Department of Agriculture, Fisheries and Forestry

- *Fisheries and the Environment – Offshore Petroleum and Greenhouse Gas Act 2006*
- *Offshore Installations Biosecurity Guide*

Commonwealth Department of Climate Change, Energy, the Environment and Water

- *Interim Engaging with First Nations People and Communities on Assessments*
- *Approvals under the Environment Protection and Biodiversity Conservation Act 1999*

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

- *Commercial Fishing Consultation Framework for the Offshore Oil and Gas Sector*
- *Consultation approach for unplanned events*.

4.3 Santos' consultation methodology

4.3.1 Overview

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

- consistent with Regulation 17(1)(b) of the P(SL)(E)R 2012
- consistent with the principles of ecologically sustainable development set out in section 3A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- by which the environmental impacts and risks of the activity will be reduced as low as reasonably practicable (**ALARP**)
- by which the environmental impacts and risks of the activity will be of an acceptable level.

The consultation process is designed to assist Santos to further ascertain, understand and assess values and sensitivities of the environment 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)
- 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 environment that may be affected by the Activity and the particular aspects of the relevant environment as part of its process for identifying relevant persons.

4.3.2 Identifying 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 4-1** summarises the preliminary steps adopted by Santos to identify relevant persons.

Table 4-1: 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 for assessment of impacts and risks.
3. Consider and identify aspects of the environment that may be affected, having regard to: 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 4-2 outlines the environmental aspects within the EMBA (described in detail in Section 3) that Santos considered for the purpose of identifying relevant person categories.

Table 4-2: Environmental aspects considered for relevant person category identification

Aspects of the environment	EP Reference
Physical environment	3.2
Provincial bioregions	3.2.2
Benthic habitats	3.2.3
National heritage place and world heritage property	3.2.6
Marine parks	3.2.6
Wetlands of international and national importance	3.2.6
Key ecological features	3.2.6
Threatened and migratory fauna	3.2.7
Biologically important areas and critical habitat	3.2.7.1
Conservation advice, recovery plans and management plans	3.2.7.3
Commercial fisheries	3.2.8.1
Energy industry	3.2.8.3
Defence activities	3.2.8.5
Shipping	3.2.8.4
Recreation and tourism	3.2.8.6
Cultural features	3.2.8.7

Consideration of the above environmental aspects resulted in the identification of the following relevant person categories:

- Commonwealth Government Departments/Agencies
- Western Australian Government Departments/Agencies
- Academic and research organisations
- Commercial fishing (Commonwealth-managed)

- Commercial fishing (Western Australian-managed)
- Energy industry titleholders / operators
- Environmental conservation organisations
- First Nations peoples and groups
- Infrastructure operators
- Industry associations
- Local Government Authorities
- Recreational fishing
- Shipping
- Tourism operators

Santos then undertook the actions outlined below to identify relevant persons within those categories.

Table 4-3: Actions for identifying relevant persons by category

Relevant person category	Actions to identify relevant persons
All relevant person categories	• Review of Santos' historical consultation in the region • Review of identified relevant persons in publicly available EPs submitted by other Operators 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 and State-wide advertising as outlined in Table 4.6
Commonwealth Government Departments/Agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of government agency guidance on consultation expectations.
Western Australian Government Departments/Agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of government agency guidance on consultation expectations.
Academic and research organisations	• Desktop review of publicly available and reasonably ascertainable published research having regard to the region, activities or risks/impacts under this EP.
Commercial fishing	• Review of EMBA overlap with commercial fisheries. • Review of WA commercial fishery activity in the Operational Area to inform consultation as per WA industry association guidance.
Energy industry	• Review of EMBA overlap with petroleum, greenhouse gas and any other NOPTA issued titles.
Environmental conservation organisations	• Conduct key-word searches of publicly available online search engines, review media coverage and review organisation websites to identify organisations with reasonably ascertainable functions, interests and activities that may be affected, having regard to the region, activities or risks/impacts under this EP. • Review of other publicly available information, eg websites of conservation organisations whose functions, interests or activities within the EMBA may be affected.
First Nations peoples and groups	• Review of EMBA overlap with Native Title determined areas and claims and Indigenous Land Use Agreements, and Indigenous Protected Areas to identify areas over which a First Nations group may have functions, interests or activities that may be affected. • Review of Native Title Representative Bodies that have functions, interests or activities that may be affected. • Conduct searches of public cultural heritage databases relative to the EMBA. • Review of prescribed bodies corporate on the Native Title website. • Review of marine park management plans. • Review of publicly available studies and reports that may assist in identifying or mapping relevant cultural heritage interests in the EMBA.

Relevant person category	Actions to identify relevant persons
Industry associations	• Review of industry representation of the following relevant person groups: – Commercial fishing – Local Government Authorities – Local industry – Recreational fishing – Shipping – Tourism operators
Infrastructure operators	• Review of EMBA overlap with offshore and onshore infrastructure, such as submarine telecommunications cables or ports. • Review of potential presence in the Operational Area.
Local Government Authorities	• 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 Operational Area. • Review of website information of relevant agencies/organisations that represent recreational fishing interests.
Shipping	• Review of EMBA overlap with shipping fairways or areas of high marine traffic
Tourism operators	• Review of EMBA overlap with areas of interest to charter and tourism operators. • Review of potential presence in the Operational Area. • Review of website information of relevant operators/organisations that represent commercial tourism interests.

4.3.3 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;
  - Individual First Nations people who self-identify as relevant (if any) and
  - Asking identified persons and organisations (including relevant land councils) if there are other persons or organisations who may be a relevant person.

For this EP, Santos has provided consultation opportunities and supporting information to First Nations representative organisations in acknowledging the use of a highly conservative EMBA (as described in **Section 3**) for the purpose of assisting to identify potentially relevant persons.

Santos acknowledges the tradition of First Nations people of Australia includes a cultural and spiritual connection to their land and waters and that communal cultural interests, including sea country, could extend into 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 people 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 operational area, where planned activities will occur.

This conservative approach (further described in **Section 4.3.7** as 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.

Santos has provided consultation opportunities to PBCs given their responsibilities under the *Native Title Act 1993* (Cth) for representing Native Title holders who have been recognised by Australian law of their rights and interests to traditional land and waters.

Santos has since mid-2023 actively been working with PBCs to establish consultation agreements to support ongoing, regular and effective consultation and engagement activities. For this EP, Santos has arrangements in place with Wirrawandi Aboriginal Corporation.

4.3.4 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 campaign outlined in Table 4-6 to raise public awareness about proposed activities and provide opportunities for authorities, persons or organisations to identify themselves as relevant persons.

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

Table 4-4: List of relevant persons

Relevant person category	Summary of relevance
Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant	
Australian Border Force (ABF) (Maritime Border Command)	ABF is Australia's border law enforcement agency and customs service. ABF's vessels undertake patrols as part of its surveillance and response activities.
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 (marine pests) (vessels, aircraft and personnel)	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 Australian territory and/or between Australian ports and offshore petroleum facilities.
Department of Agriculture, Forestry and Fisheries (DAFF) –Fisheries	DAFF 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 (UCH)	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 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:

Relevant person category	Summary of relevance
	• 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 an Australian Marine Park; and/or • an environmental incident occurs in Commonwealth waters surrounding an Australian Marine Park and may impact on the values within the Australian Marine Park.
Departments or agencies of Western Australia to which the activities to be carried out under the environment plan may be relevant.	
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA is a relevant State agency responsible for the management of State marine parks and reserves and protected marine fauna and flora.
Department of Planning, Lands and Heritage (DPLH)	DPLH is responsible for WA state level land use planning and management, and oversight of Aboriginal cultural heritage and built heritage matters.
Department of Primary Industries and Regional Development (DPIRD) – Fisheries	DPIRD is responsible for managing Western Australian fisheries.
Department of Transport (DoT) – marine pollution	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 responding to an unplanned spill event through its Maritime Environmental Emergency Response unit.
Department of Jobs, Tourism, Science and Innovation (JTSI)	JTSI is a Western Australian Government statutory authority responsible for promoting Western Australia as a holiday destination.
Department of Water and Environmental Regulation (DWER)	DWER is responsible for environment and water regulation.
Pilbara Development Commission (PDC)	PDC is a Western Australian Government statutory authority dedicated to the economic and social development of the Pilbara region.
Western Australian Museum (WAM)	WAM maintains a database of shipwrecks off the Western Australian coast.
Port of Dampier	The Port of Dampier is located near Karratha and predominantly used for the export of iron ore, LNG, salt and condensate.
Port of Onslow	The Port of Onslow is a multi-user port located in Onslow on the West Australian coast and predominantly used for commodity exports, supply base services and recreation.
Commercial fishing – Commonwealth managed	
Commonwealth-managed fisheries that overlap the EMBA (based on AFMA guidance): • Southern Bluefin Tuna Fishery • Western Skipjack Tuna Fishery • Western Tuna and Billfish Fishery	Santos has engaged representative organisations and Government agencies, on behalf of relevant fisheries, including providing information on those fisheries active in the operational area and those that are licenced to fish in the EMBA. No Commonwealth fisheries are active in the Operational Area.
Commercial fishing – Western Australia managed	
State fisheries that overlap with the EMBA and are active in the Operational Area (based on WAFIC guidance): • Mackerel Managed Fishery	Santos has engaged representative organisations and Government agencies, on behalf of relevant fisheries, including providing information on those fisheries active in the operational area and those that are licenced to fish in the EMBA.

Relevant person category	Summary of relevance
• Marine Aquarium Managed Fishery • Pilbara Fish Trawl Managed Fishery • Specimen Shell Managed Fishery • West Australian Sea Cucumber Fishery	
Energy Industry- Petroleum titleholders and GHG permit holders	
Operators: • Allasso Energy P/L • Chevron Australia P/L • Coastal Oil & Gas • Energy resources Ltd • Jadestone Energy • Vermillion O&G Australia • Woodside Energy	Titleholders within the EMBA.
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.	
First Nations Peoples and Groups - Representative Organisations (Western Australia)	
Murujuga Aboriginal Corporation (MAC)	The EMBA intersects the Dampier and Montebello Marine Parks, the management plan for which references YMAC. Santos has consulted with MAC.
Ngarluma Aboriginal Corporation (NAC)	The EMBA is adjacent to the Ngarluma/ Yindjibarndi Native Title determined area, which is jointly managed by Ngarluma Aboriginal Corporation (NAC) and Yindjibarndi Aboriginal Determination. NAC manage the northern, coastal part of the determination. The EMBA intersects the Dampier Marine Park, the management plan for which references NAC. Santos has consulted with NAC.
Wirrawandi Aboriginal Corporation (WAC)	The Operational area is adjacent to, intersects the Yaburara and Mardudhunera Native Title determined area. The EMBA intersects the Yaburara and Mardudhunera Native Title determined area. WAC is the Registered Native Title Body Corporates holding native title on behalf of the Yaburara and Mardudhunera people. The EMBA intersects the Dampier Marine Park, the management plan for which references WAC. Santos has consulted with WAC.
Yamatji Marlpa Aboriginal Council (YMAC)	YMAC is the Native Title Representative Body (NTRB) that facilitates native claims on behalf of First Nations people and groups, as well as acting in the interests of Native Title Prescribed Body Corporates where directed by Corporation Directors. YMAC is the NTRB for the Pilbara region. The EMBA intersects the Dampier, and Montebello Marine Parks, the management plans for which references YMAC. Santos has consulted with YMAC.

Relevant person category	Summary of relevance
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.
Tuna Australia (TA)	TA represents the interests of the Western Tuna and Billfish Fishery.
Western Australian Fishing Industry Council (WAFIC)	WAFIC represents the interests of the WA commercial fishing, pearling and aquaculture sector.
Western Rock Lobster (WRL)	Western Rock Lobster (WRL) is the peak industry body representing the interests of the western rock lobster commercial fishing industry.
Industry associations - Local industry	
Karratha and Districts Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Onslow Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Industry Associations – Energy	
Australian Energy Producers	AEP represents the interests of oil and gas explorers and producers in Australia.
Industry Associations – Tourism	
Recfishwest	Recfishwest represents the interests of Western Australia's recreational fishing sector.
Marine Tourism WA (MTWA)	The MTWA is an association made up of charter industry owners and operators.
Tourism Council of Western Australia	Tourism Council WA is the peak body representing tourism businesses, industries and regions in Western Australia.
WA Game Fishing Association (WAGFA)	WAGFA co-ordinates the activities of game fishing throughout Western Australia, maintains State game fishing records and data concerning open game fishing tournaments of its member clubs. WAGFA members are: • Broome Fishing Club • Cockburn Power Boats • Exmouth Game Fishing Club • Fremantle Sailing Club • Geraldton and District Offshore Fishing Club • King Bay Gamefishing Club • Marmion Angling and Aquatic Club • Naturaliste Game and Sports Fishing Club • Nor-West Game Fishing Club • Perth Game Fishing Club

Relevant person category	Summary of relevance
Western Australian Indigenous Tourism Operators Council (WAITOC)	WAITOC is the peak representative for Aboriginal tours and experiences in Western Australia.
Infrastructure operators	
Vocus	Owner and operator of an offshore fibre network intersecting the EMBA.
Local Government Authorities	
Shire of Ashburton	The Shire of Ashburton is a local government area in the Pilbara region of Western Australia.
City of Karratha	The City of Karratha is a local government area in the Pilbara region of Western Australia.
Tourism Operators – Dive	
Aussie Marine Adventures (Exmouth & Coral Bay)	Marine tourism operator active within the EMBA.
Mackerel Islands (Onslow)	Marine tourism operator active within the EMBA.
Tourism Operators – Charter operators	
Mackerel Islands Fishing Charters	Marine tourism operator active within the EMBA.
Mahi Mahi Fishing Charters	Marine tourism operator active within the EMBA.
Onslow Bay Boatworks	Marine tourism operator active within the EMBA.
Seaestar Boat Charters	Marine tourism operator active within the EMBA.
Seaforce Charters	Marine tourism operator active within the EMBA.
Top Gun Charters	Marine tourism operator active within the EMBA.

4.3.5 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
- How to provide feedback.

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.

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

Examples of the consultation materials used are included in Appendix F.

4.3.6 Consultation approach

In developing this EP Santos has made itself available to work with authorities, persons and organisations on pragmatic and practical approaches to consultation.

In its preliminary consultation emails, Santos invited feedback on appropriate consultation methods and information needs. 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.

Santos' 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:

- Developing a fact sheet specific to the information needs of the commercial fishing sector.
- 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.
- 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.
- Making information available to potentially affected commercial fishing licence holders in Western Australian managed fisheries on the WAFIC web site at https://www.wafic.org.au/what-we-do/access-sustainability/oil-gas/consultationhubtrial/ for the duration of the consultation period.
- 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 EMBA's that may have broader implications for recreational fishers. This approach acknowledges DPIRD's estimated 620,000 recreational fishers in Western Australia.

A schedule of consultation activities is included in Table 4-5and a schedule of advertising is included in Table 4-6.

4.3.7 Reasonable period for consultation

Santos is required to allow a relevant person a reasonable period for consultation.

Santos provided approximately 60 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 specific cases where additional consultation was necessary, Santos allocated a shorter timeframe for reviewing and providing feedback on the proposed activity.

Santos directly contacted relevant persons notifying them of the consultation process and consultation period, confirming the date by which feedback was sought and outlining how feedback may be provided.

4.3.8 Consultation opportunities

Santos offered multiple avenues and mediums for consultation, including:

- Response by return email
- Provision of a toll free 1800 number
- In-person or virtual meetings, as appropriate.

Following initial correspondence and/or in person conversations, attempts were made to follow up where no response was received.

Table 4-5: Summary of consultation activities

Activity	Purpose	Timing
Preliminary Consultation 30 May- 28 June 2024		
Website Website content and activity fact sheets developed and made available at https://www.santos.com/offshoreconsultation/carnarvon/	Provide: • Information about Santos' consultation obligations and approach. • Descriptions of proposed activities, including potential activity impacts and risks, and proposed management measures. • Contact information to enable relevant persons to provide feedback. • Information about how to self-identify as a relevant person, including an online nomination form. • Details about how feedback will be managed, including provision of Santos' offshore Western Australia	From 30 May 2024
Advertising Advertisements in the following publications: • The West Australian • Midwest Times • North West Telegraph • Pilbara News Guardian Advertisements on the following radio stations: • Karratha HIT 106.5 • WA Remote HIT WA FM • Pilbara and Kimberley Aboriginal Media Radio	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 30 May 2024
Consultation materials Email to identified relevant persons with a link to the fact sheet for this EP	Provide Relevant Persons with details on proposed Activities, including potential activity impacts and risks, and proposed management measures, and establish consultation expectations.	From 30 May 2024

Activity	Purpose	Timing
Consultation 28 June-29 July 2024		
Consultation materials Email to identified relevant persons advising the commencement of consultation	Reminder to Santos identified relevant persons of the commencement and closing dates for consultation.	From 28 June 2024
Advertising Advertisements in the following publications: • The West Australian • Midwest Times • North West Telegraph • Pilbara News Guardian Advertisements on the following radio stations: • Karratha HIT 106.5 • WA Remote HIT WA FM • Pilbara and Kimberley Aboriginal Media Radio	Promote awareness of proposed activities and seek feedback from relevant persons	From 28 June 2024
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 28 June 2024

Table 4-6: Consultation advertising (30 May- 29 July 2024)

Publication date	Advertising type	Towns / Communities	Reach
Preliminary consultation 30 May- 28 June 2024			
30 May–28 Jun 2024	Social Media notice	Facebook, Instagram and Messenger	Geotargeted PPL18+ Pilbara and Exmouth
30 May–28 Jun 2024	Radio Ad - Karratha HIT 106.5	Karratha towns and communities, focusing on remote communities	N/A
30 May–28 Jun 2024	Radio Ad - WA Remote HIT WA FM	WA remote towns and communities	N/A
30 May–28 Jun 2024	Radio Ad - Pilbara and Kimberley Aboriginal Media Radio	Pilbara and Kimberley towns and communities, focusing on remote communities	N/A
3 Jun 2024	Press Ad Western Australian	Half page, page 11	Targeted WA with reach of 359,000
19 Jun 2024	Press Ad North West Telegraph	Half page, page 6	Targeted WA with reach of 8,154
19 Jun 2024	Press Ad Midwest Times	Half page, page 9	Targeted WA with reach of 50,534
19 Jun 2024	Press ad Pilbara News Guardian	Half page, page 11	Targeted WA with reach of 17,611
Consultation 28 June to 29 July 2024			
28 Jun–29 Jul 2024	Social Media notice	Facebook, Instagram and Messenger	Geotargeted PPL18+ Pilbara and Exmouth
28 Jun–29 Jul 2024	Radio Ad - Karratha HIT 106.5	Karratha towns and communities, focusing on remote communities	N/A
28 Jun–29 Jul 2024	Radio Ad - WA Remote HIT WA FM	WA remote towns and communities	N/A
28 Jun–29 Jul 2024	Radio Ad - Pilbara and Kimberley Aboriginal Media Radio	Pilbara and Kimberley towns and communities, focusing on remote communities	N/A
1 Jul 2024	Press Ad Western Australian	Half page, page 11	Targeted WA with reach of 359,000

Publication date	Advertising type	Towns / Communities	Reach
17 Jul 2024	Press Ad North West Telegraph	Half page, page 4	Targeted WA with reach of 8,154
17 Jul 2024	Press Ad Midwest Times	Half page, page 11	Targeted WA with reach of 50,534
17 Jul 2024	Press ad Pilbara News Guardian	Half page, page 6	Targeted WA with reach of 17,611

5. Impact and risk assessment

P(SL)(E)R 2012
Regulation 14(3)
The environment plan must include: a) Details of all environmental impacts and environmental risks of the petroleum activity; and b) An evaluation of those impacts and risks; and c) A description of the environmental risk assessment process used to evaluate those impacts and risks, including the terms used in that process to categorise the levels of seriousness of those impacts and risks.
Regulation 14(4)
For the avoidance of doubt, the evaluation mentioned in subregulation (3)(b) must evaluate all the environmental impacts and environmental risks arising directly or indirectly from: a) all aspects of the petroleum activity; and b) potential emergency conditions, whether resulting from accident or any other cause.

Environmental impact and risk assessment refers to a process whereby planned and unplanned events that may or will occur during an activity are quantitatively and/or qualitatively assessed for their impacts on the environment (physical, biological, and socio-economic) at a defined location and specified period of time. In addition, unplanned events are assessed based on their likelihood of occurrence which contributes to their level of risk.

Santos has undertaken environmental impact and risk assessments for the operational activities planned events (including any routine, non-routine and contingency activities) and unplanned events in accordance with P(SL)(E)R 2012.

Provided in this section of the EP is the following information relating to the environmental impact and risk assessment approach:

- Terminology used
- Summary of the approach.

A full description of the process applied in identifying, analysing and evaluating the impacts and risks relating to the planned activity is documented in the Santos' Offshore Division Environmental Hazard Identification and Assessment Procedure (EA-91-IG-00004_5).

5.1 Impact and risk assessment terminology

Common terms applied during the impact and risk assessment process, and used in this EP, are defined in Table 5-1. For a more comprehensive listing of the terms and definitions used in environmental impact and risk assessment, refer to *Environmental Hazard Identification and Assessment Procedure* (EA-91-IG-00004).

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' Environment, Health & Safety Policy, consistency with all applicable legislation and consideration of relevant stakeholder consultation when determining management measures.
Activity	Specific tasks and actions undertaken throughout the life cycle of oil and gas exploration, production and decommissioning.
ALARP	As Low As Reasonably Practicable The term refers to reducing 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 practicable options that could reasonably be adopted to reduce risks further.
Authorised Person	Person with authority to make the decision or take the action. Examples are Vessel Master, Field Superintendent, Supervisor, Person-in-charge, Company Authorised Representative, and Project Manager.

Term	Definition
Control Measure	Means a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks
EMBA	Environment that may be affected by planned or unplanned events.
ENVID	Environmental hazard identification workshop.
Environment	Includes the natural and socio-economic values and sensitivities which will or may be affected by the activity. Is defined by NOPSEMA and DEMIRS 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. (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 NOPSEMA[3] as any change to the environment, whether adverse or beneficial, that wholly or partially results from the activity Defined by DEMIRS as any change to the environment, whether adverse or beneficial, that wholly or partly results from a petroleum activity of an operator.
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 period of time.
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	A description of the activity to be undertaken including the services, equipment, products, assets, personnel, timing, duration and location and aspect of the activity.
Planned event	An event arising from the activity which 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, bilge water discharge and drill cuttings discharge would be 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 period of time.
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.
SLT	Senior Leadership Team
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.

[3] *Defined by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023*

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 (SMS MS1 ST01) 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. The forum used to undertake the assessment is the environmental hazard workshop, referred to as an ENVID, which is described in Section 4 of *Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline* (EA-91-IG-00004_5).

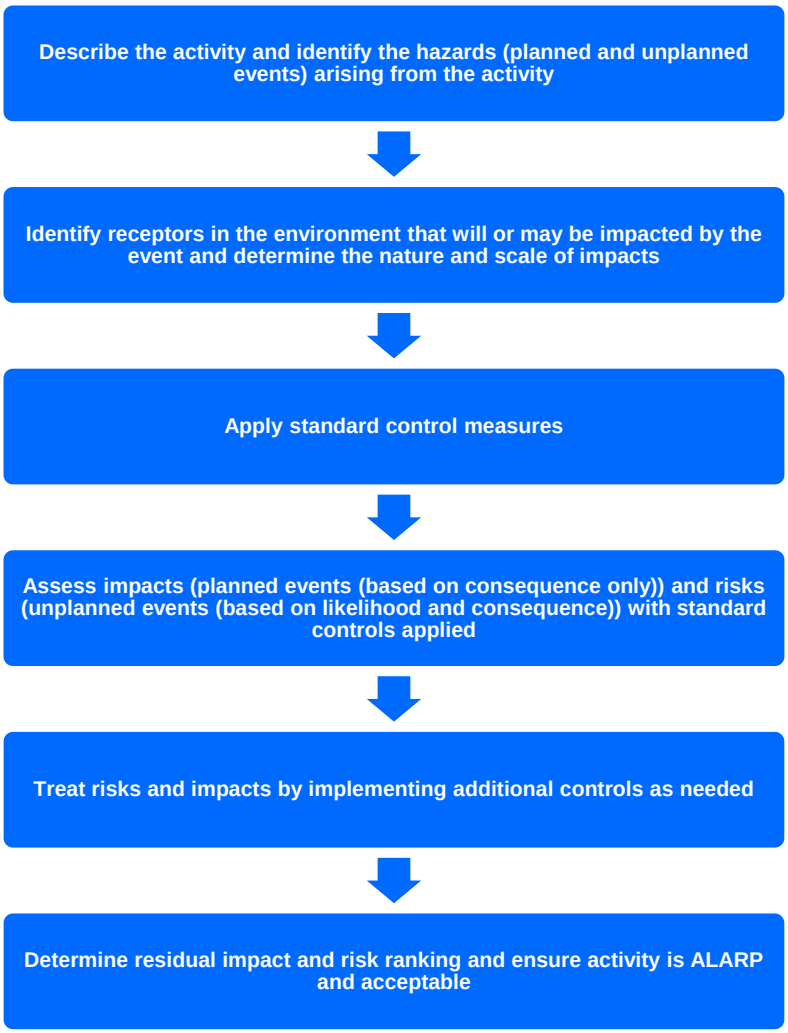


Figure 5-1: Environmental impact and risk assessment process

Santos' Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of the following key areas in an impact and risk assessment:

- Description of the activity (including location and timing)
- Description of the environment (potentially affected by both planned and unplanned activities)
- Identification of relevant persons
- Identification of legal requirements ('legislative controls') that apply to the activity
- Santos Environment, Health & Safety Policy and SMS requirements
- Principles of Ecologically Sustainable Development (ESD)
- Santos acceptable levels of impact and risk.

These factors were considered in an environmental impact and risk assessment workshop held in May 2024 in which environmental hazards were identified and assessed (ENVID workshop). The workshop involved participants from Santos' Health, Safety and Environment (HSE) the Drilling and Completions department and specialist environmental consultants.

To determine reportable incidents, in accordance with Section 4.2.1 of DEMIRS Guideline for the Development of Petroleum, Geothermal and Pipeline Environment Plans in Western Australia, Santos held a second workshop on 24th June 2024, to assess the consequence of both planned and unplanned events without controls in place, resulting in each event being given a 'Pre-Treatment consequence'. Pre-treatment risk is defined as the risk rating for an event before control measures (EPSs) are applied. The pretreatment risk rating reflects the worst-case scenario (i.e. the worst possible consequences and their likelihood of occurrence in the absence of risk management). This can be found within the Environmental Impact assessment sub-section of each event.

5.2.2 Describe the activities and hazards (planned and unplanned events)

A description of the activity is required in order to determine the planned events that will take place and the credible unplanned events that may occur. The location, timing and scope of the activity must be described in order to determine the impacts from planned events, and the impacts and risks from unplanned events since these have a bearing upon the environment that may be affected (EMBA) by the activity.

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 (natural and socio-economic) 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 environment 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.

Santos has developed an activity specific Devil Creek Operations EP Values and Sensitivities of the Marine and Coastal Environment Appendix C a reference document that describes the existing environment that may be affected by the activities in this EP.

The extent of actual impacts from each planned activity or risks from each unplanned activity are assessed using, where required, modelling (e.g. hydrocarbon spills) and scientific reports. The duration of the event is also described, including the potential duration of any impacts should they occur. Receptors identified as potentially occurring within an impacted area or areas are detailed Section 3 and Appendix C.

5.3 Describe the environmental performance objectives and control measures

For each planned and unplanned event, a set of Environmental Performance Objective(s), Control Measures, Environmental Performance Standards and Measurement Criteria are consistent with Petroleum Environment Regulations.

As described in the Guideline for the Development of Petroleum and Geothermal Environment Plans in Western Australia' (DEMIRS Guidelines 2022):

- Environmental Performance Objective(s) must be defined in such a way that the performance for protecting the environment can be measured and should relate to the identification and assessment of environmental impacts and risks.
- For each performance objective the EP should include at least one standard (may include more). This may include procedures, codes and guidelines, and should be consistent with the Santos Environment, Health and Safety Policy and legislation outlined in this EP.
- Measurement criteria should allow direct measurement of performance by monitoring, data analysis, inspection and audit.

The 'standard' Environmental Performance Standards and Measurement Criteria for the EPOs and Control Measures adopted for this activity are described in each section.

For any hazard, additional controls, must also be considered and either accepted for use or rejected based on whether the standard controls reduce impacts and risks to levels that are ALARP and acceptable (refer Sections 5.5 and 5.6).

Controls are allocated in order of preference according to 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 (on the basis that all control measures have been implemented)

This step looks at the causal effect between the event and the identified receptor. Impact mechanisms and any thresholds for impacts are determined and described, using scientific literature and modelling where required. Impact thresholds for different critical life stages are also identified where relevant.

The consequence level of the impact is then determined for each planned and unplanned event using the Santos Environment Consequence Descriptors (Appendix G).

These detailed environmental consequence descriptions are based on the consequence of the impact to relevant receptors in the following categories:

- Threatened, migratory or local fauna
- Physical environment or habitat
- Threatened ecological communities
- Protected areas
- Socio-economic receptors.

This process determines a consequence level, based on set criteria for each receptor category, and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. Consequence levels are provided in Table 5-2

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur. Likelihood rankings are provided in the Santos risk in Table 5-3.

The level of information required to complete the impact or risk assessment depends on the nature and scale of the impact or risk. This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. Impacts to social and economic values are also considered based on

existing knowledge and feedback from stakeholder consultation. As the result of historic consultation with stakeholders, the social and economic values in the region that are of interest are evident.

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

Table 5-2: Consequence level description

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.

Note: Injury or mortality to a protected species is included as a moderate consequence level.

For unplanned events, the consequence level of the impact is combined with the likelihood of the impact occurring (Table 5-3) to determine a residual risk ranking using the corporate Santos risk matrix (Table 5-4). For oil spill events, potential impacts to environmental receptors are assessed where they occur within the EMBA using results from modelling

Table 5-3: Likelihood description

No.	Matrix	Description
f	Almost Certain	Occurs frequently (<4 monthly)
e	Likely	Could occur within the annual plan (4 monthly to 1 yearly)
d	Occasional	Could occur within the 3-year plan (1–3 yearly)
c	Possible	Could occur within the 10-year, long-term plan (3–10 yearly)
b	Unlikely	Not expected to occur; known to have occurred elsewhere (10–30 yearly)
a	Remote	Requires exceptional circumstances and is unlikely even in the long term (30–100 yearly)

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 Evaluating if impacts and risks are ALARP

For planned and unplanned events, an ALARP assessment is 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 in order 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 upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as `Medium' compared to a risk ranked as `Low'.

5.6 Evaluating impact and risk acceptability

Santos considers an impact or risk associated with the proposed activity to be acceptable if the following criteria are met:

- 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 whether further information or studies are required to support or validate the consequence assessment
- The acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice can be demonstrated
- Performance standards are consistent with legal and regulatory requirements
- Performance standards are consistent with Santos Environment, Health & Safety Policy
- Performance standards are consistent with industry standards and best practice guidance (e.g. Australian Biofouling Management Requirements, Version 2 (DAFF 2023); National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry) (Marine Pest Sectoral Committee, 2018)
- Performance objectives and standards are consistent with stakeholder expectations
- Performance standards have been demonstrated to reduce the impact or risk to ALARP
- the consequence and risks associated with the proposed activity are not inconsistent with the outcomes of relevant principles of ecologically sustainable development (ESD) under the EPBC Act, as summarised in Table 5-5.

Table 5-5: Activity relevant principles of ecologically sustainable development

No.	ESD Principle	Relevance
(a)	Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	Santos' environmental impact and risk assessment determines impact consequence levels considering the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem, or industry level. The Santos Environment Consequence Descriptors highlights the integration of long-term and short-term environmental, and socio-economic considerations (Appendix G) The assessment of impact consequence levels for the proposed activity simultaneously assesses of the activity's potential implications against this principle. Additional assessment of this principle in relation to acceptability will not be conducted.
(b)	If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	For planned activities, assessment of this ESD principle is inherent in Santos' environmental impact and risk assessment process, as Santos does not proceed with activities if the consequence of a planned event is ranked III (Moderate) or above. If the residual risk is Medium to Very High and there is significant scientific uncertainty associated with the aspect, additional assessment against this principle is required.
(c)	The principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations	For planned activities, assessment of this ESD principle is inherent in Santos' environmental impact and risk assessment process, as Santos does not proceed with activities if the consequence of a planned event is ranked III (Moderate). The assessment of this principle is implemented through further details on ALARP assessment highlighting assurance that potential impacts and risks are managed, and the environment is maintained for the benefit of future generations. Evaluation of the importance and relevance of stakeholder interest for this principle, if triggered, is fundamental in demonstrating that the environment is maintained for the benefit of future generations.
(d)	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	Evaluate if there is the potential to affect biological diversity and ecological integrity.
(e)	Improved valuation, pricing and incentive mechanisms should be promoted	This principle refers to activities which involve valuation, pricing and/or incentive mechanisms for the production, delivery, distribution or consumption of goods

No.	ESD Principle	Relevance
		and services, especially those that are derived from natural or social capital or from ecological services.

5.6.1 First Nations cultural features assessment

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 about cultural and spiritual beliefs that do not link to a specific place (or physical/tangible feature), Santos will evaluate impact and risk acceptability through the consideration of:

- Impacts from other activities in the vicinity of the EP activities (e.g. historical drilling, trawl fishing activity, shipping, commercial developments).
- Information provided from people and /or organisations who assert the cultural and spiritual connections.
- Any expert assessment(s) from suitably qualified expert(s) with relevant experience and credentials.
- Culturally appropriate control measures raised by relevant people, organisations or experts; or proposed by Santos and workshopped with relevant people, organisations or experts.

Impact and risk evaluation of cultural and spiritual beliefs will not form part of an ENVID workshop, and a consequence (or risk) ranking will not be assigned. Instead, a qualitative assessment demonstrating that impacts and risks of the activity will be reduced to as low as reasonably practicable and be of an acceptable level will be presented in the EP as informed by the above considerations.

6. Environmental assessment for planned activities

P(SL)(E)R 2012 Requirements
Regulation 14(3)
The environment plan must include: a) details of all environmental impacts and environmental risks of the petroleum activity; and b) an evaluation of those impacts and risks; and c) a description of the environmental risk assessment process used to evaluate those impacts and risks, including the terms used in that process to categorise the levels of seriousness of those impacts and risks.
Regulation 14(4)
For the avoidance of doubt, the evaluation mentioned in subregulation (3)(b) must evaluate all the environmental impacts and environmental risks arising directly or indirectly from: a) all aspects of the petroleum activity; and b) potential emergency conditions, whether resulting from accident or any other cause

Two ENVID workshops (as described in Section 5) for planned and unplanned activities were held on 30 April 2024 and 02 May 2024, covering both the Reindeer and Devil Creek facilities. This workshop identified potential sources of environmental impact associated with the planned activities for this activity. The consequence rankings resulting from the environmental assessments are summarised in Table 6-1. A comprehensive risk and impact assessment for each of the planned events, and subsequent control measures proposed by Santos to reduce the risk and impacts to ALARP and acceptable levels are details in the following subsections.

Table 6-1: Summary of the consequence level rankings for hazards associated with planned events

EP Section	Hazard	Pre-treatment Consequence level	Residual Consequence Level
6.1	Interaction with terrestrial fauna and flora	II – Minor	II – Minor
6.2	Noise emissions	I – Negligible	I – Negligible
6.3	Light emissions	I – Negligible	I – Negligible
6.4	Atmospheric emissions	I – Negligible	I – Negligible
6.5	Seabed and benthic habitat disturbance	II – Minor	I – Negligible
6.6	Interaction with other users	I – Negligible	I – Negligible
6.7	Planned operational discharges	II – Minor	I – Negligible
6.8	Planned chemical and residual hydrocarbon discharges	II – Minor	I – Negligible
6.8	Spill response operations	II – Minor	II – Minor

6.1 Interaction with terrestrial fauna and flora

6.1.1 Description of event

Event	During the operational life of the activity, interactions with terrestrial fauna and flora may occur from the following activities during operations, IMMR and CoP activities: • Non-routine excavations within the onshore component of the operational area. • Routine and non-routine vegetation clearing within the onshore component of the operational area. ***Excavation activities*** Excavation may be required from time to time during the life of the EP as part of IMMR activities. Due to the non-routine nature of excavations, it is not possible to predict an exact location along the DC pipelines, or precise extent, of the excavations. However, it is expected that excavations would be relatively small (up to 15 m in length, 3 m in width and 2 m in depth) and short-term in duration (a few days). As excavations would be associated with particular IMMR activities of the pipeline they would be occurring in previously disturbed areas ***Vegetation clearing activities*** Vegetation clearing occurs as part of non-routine excavations and other activities as required such as maintenance of access tracks, or if line of sight between the pipeline markers is lost. In these circumstances a native vegetation clearing permit may be required as will a project execution plan, if excavation is required. Activities requiring vegetation clearing would be undertaken in a manner to minimise the area of clearing required and to allow sufficient time to apply for relevant permits as required (such as native vegetation clearing permits). Noting that clearing outside of the already cleared area is not required. Under emergency situations where excavation of the pipeline is required, it is unlikely there would be time to obtain approval for a Native Vegetation Clearing Permit. Under these circumstances, a permit exemption to clear native vegetation resulting from accidents or to reduce danger (Regulation 51c) under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* would allow for vegetation clearing.
Extent	Localised excavations to occur within the onshore operational area. Small sections of the pipeline (approximately 15 m in length, 3 m in width and 2 m in depth) are expected to be affected. Localised vegetation clearing to occur within the onshore operational area. Small sections of the pipeline or small areas of access tracks are anticipated to be affected.
Duration	Routine and non-routine as required for IMMR and CoP activities.

6.1.2 Nature and scale of environmental impacts

Potential Receptors: Native flora and vegetation, native fauna, shallow groundwater, sediment quality.

Routine vegetation clearing and non-routine excavations and vegetation clearing may result in direct impacts to native flora and vegetation as well as native fauna through clearing of important habitat. Further, excavation activities pose potential risks of exposing acid sulphate soils and intercept shallow groundwater.

However, because the onshore pipeline is in a previously disturbed area and the non-routine activities are expected to be small scale and short term, the level of impact is limited.

Based on publicly available information, there are no threatened ecological communities, threatened flora or priority flora within the operational area. There are two Priority Ecological Communities (PECs) which are identified as being within large areas around the operational area including small portions that overlap the operational area (Appendix C). Vegetation clearing is the only relevant impact to the PECs. Any vegetation clearing is short-term, infrequent and small in scale. In addition, the PECs have a broad distribution surrounding the pipeline, any impact would only be on a local scale and not impact the values of the PEC**.**

The vegetation along the operational area was cleared during the construction of the pipeline and rehabilitated in accordance with MS 795. However, since rehabilitation, the OEPA have inspected the area and concluded that the quality of vegetation within the rehabilitated areas is poor due to factors outside Santos control. The vegetation in the area has been disturbed by activities which occurred prior to the pipeline operations. Weed proliferation (particularly Buffel grass) is widespread in the region. The condition of vegetation varies by season and, although controlled, weed proliferation still occurs and reduces native species cover and diversity. This is largely attributed to external factors, such as public vehicle, road maintenance and livestock activities, causing continuous disturbance.

Impacts to vegetation and flora from operations are considered negligible due to the scale of activities and given there is no high-quality flora or vegetation within the operational area. The DC supply pipeline has not been excavated in the last 5 years and there are no intentions to excavate the pipeline unless for pipeline repair. A risk assessment is conducted prior to excavation, to allow controls to be applied appropriately to the risks in a project execution plan.

There are a number of EPBC Listed fauna that may be found within the operational area. Therefore, clearing of vegetation may clear or disturb important habitat. However, as mentioned above, the vegetation within the operational area is poor quality and therefore it is expected that there would not be any high-quality habitat.

Non-routine planned excavations introduce the potential for fauna entrapment and exposure of acid sulphate soils or interception of shallow groundwater. A search of the publicly available acid sulphate soil database identified that there is a low to moderate probability of acid sulphate soils being present within the operational area. However, as the excavations are expected to be small scale and short term in nature the impacts from exposing acid sulphate soils is limited. Furthermore, excavations will only be required to be as deep as the pipeline further reducing the potential for exposure of acid sulphate soils.

Excavations also have the potential to cause entrapment of fauna and as mentioned, there are a number of EPBC Listed fauna that may be found within the operational area. The potential impacts associated with entrapment of fauna is discussed further in Section 7.5.2.2 (unplanned terrestrial flora and fauna interaction), which concludes that due to the small scale, non-routine and short duration of any excavation activities any impacts would be limited.

6.1.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- No injury or mortality to EPBC Act and WA *Biodiversity Conservation Act 2016* listed fauna during activities [EPO-DC-01].

The control measures considered for this event are shown in Table 6-2, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-2: Control measures evaluation for planned interaction with terrestrial flora and fauna

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-01	Obtain a native vegetation clearing permit if required.	Administrative	Clearing in accordance with a native vegetation clearing permit will ensure that the impacts have been fully assessed and appropriate control measures are in place.	Cost (time and materials) associated with applying for a native vegetation clearing permit and implementation of associated controls.	**Adopted** – Environmental benefit and legal requirement outweigh potential costs.
DC-CM-02	Project execution plan for management of excavation activities.	Administrative	Any environmental impacts that do not have standard controls in place can be risk assessed and controls implemented to avoid or manage the risks associated with excavations and associated vegetation clearing including acid sulphate soil management.	Cost (time and materials) associated with preparation of project execution plan and implementation of controls.	**Adopted** – Environmental benefit and legal requirement outweigh potential costs.
Additional Controls					
N/A	Elimination of excavations and associated vegetation clearing for pipeline maintenance or inspection.	Eliminate	Eliminates the requirement for vegetation clearing and excavation.	Excavations will only be planned when required for maintenance activities and when no feasible alternative is available. Eliminating this activity could result in safety and operational impacts.	**Rejected** – increased risk to operations and safety from not being able to complete maintenance tasks that require excavations.

6.1.4 Environmental impact assessment

Receptor	Consequence Level
Interaction with Terrestrial Fauna and Flora	
Threatened, migratory or local fauna	Excavations may present opportunities for fauna to be trapped or injured in trenches. However, the duration and extent of excavations are expected to be limited and controls will be in place appropriate for the activities, and in accordance with the project execution plan, to minimise impacts to fauna. The consequence level for fauna is considered to be I – Negligible.
Physical Environment or habitat	Vegetation clearance and excavation may have detectable but localised and negligible loss of area/function of physical environment/habitat, reducing available habitat to fauna. The Priority Ecological Communities surrounding the pipeline have a broad distribution, any impact would only be on a local scale and not impact the values of the PEC. Rapid recovery evident within approximately one year (i.e. seasonal recovery, and a detectable but insignificant decreased in local population size of fauna (including protected fauna). The consequence level for physical environment or habitat is considered to be I – Negligible from vegetation clearance and excavation. There is the potential for moderate to high chance of acid sulphate soils in the operational area which could be exposed during excavation. The potential impacts from this are assessed as a II - Minor consequence.
Threatened ecological communities	There are no threatened ecological communities located within areas where excavation and/or vegetation clearing may occur.
Protected Areas	There are no protected areas located within areas where excavation and/or vegetation clearing may occur.
Socio-economic receptors	There are no known socio-economic receptors within areas where excavation and/or vegetation clearing may occur.
Pre-treatment consequence	II - Minor
Overall worst-case consequence level	II - Minor

6.1.5 Demonstration of ALARP

Impacts associated with non-routine excavations and vegetation clearing are short-term and small in scale. Controls that have been adopted adequately to manage the potential impacts and further controls would not further reduce the level of impact. Terrestrial fauna and flora disturbance cannot be eliminated, as the elimination of planned maintenance may potentially result in more severe environmental impacts (e.g. a hydrocarbon spill due to pipeline leak) and compromise safety requirements. It is considered that there are no additional practicable risk reduction measures to those described that would not provide a grossly disproportionate benefit to the environment. It is therefore considered that the control measures identified for seabed disturbance, which Santos will implement, will reduce the impact and risk to ALARP.

6.1.6 Acceptability evaluation

Is the consequence ranked as I (Negligible) or II (Minor)?	Yes – Maximum consequence from interaction with terrestrial fauna and flora is II- Minor.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management is consistent with the EP Act of WA and the EPBC Act. In particular, if clearing of native vegetation is required it will be conducted in accordance with the Environment Protection (Clearing of Native Vegetation) Regulations 2004.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos' Environment, Health & Safety Policy.

Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Onshore activities will result in some level of terrestrial disturbance; however, with consideration of the control measures in place, based on Santos' consequence matrix (Table 5-4), the worst impact is assessed as 'II-Minor'.

No stakeholder concerns have been raised regarding the activity.

With the control measures in place, including compliance with industry standards and legislation, no significant impacts are expected. The impacts of terrestrial fauna and flora disturbance to the receiving environment are ALARP and considered environmentally acceptable. Consequence is ranked minor due to the potential interaction with acid sulphate soils. Given the non-routine, short term nature of the activities and the low sensitivity of receptors Santos considers this risk acceptable.

6.2 Noise emissions

6.2.1 Description of event

Event	Anthropogenic noise emissions will be generated by the activities within the DC operational area. The main sources of noise emissions during ongoing operations, IMMR and CoP activities include noise to air or water from: • Inspection, maintenance, monitoring and repair activities of the subsea infrastructure (e.g. use of ROV, SBES, SBP, MBES, SSS, AUV, diving operations, marine growth cleaning, pigging, modification and replacement of components) • Support vessel activities during IMMR activities (e.g. vessel engines, thrusters and other machinery) • Onshore drones or land-based vehicles • Use of unmanned aerial vehicles and helicopter activities in the operational area Noise originating from these sources could potentially have a negative physiological or behavioural effect on marine and/or terrestrial fauna.
Extent	Impacts from all potential noise sources will be localised. This is based on: • A support vessel using main engines and bow thrusters to maintain position will become inaudible above background noise within an approximately 20 km radius. • A conservative estimate for the use of geophysical equipment (SBESs, MBESs, SSS and SBP) is within a few hundred metres radius depending on the activity characteristics. • ROV, AUV and diving operations will occur in the area of the activity and adjacent to pipeline infrastructure. • Aerial or other land-based vehicles will occur in the area of the onshore infrastructure.
Duration	Intermittently while undertaking the activity within the operational area (onshore and offshore).

6.2.1.1 Noise generated from support vessels

Vessel operational noise consists of machinery noise (e.g. engine noise, propeller cavitation, thrusters) and hydrodynamic noise (e.g. water flowing past the hull and propeller singing). Machinery on a ship radiates sound through the hull into the water. However, sound emitted from support vessels differs significantly depending on factors such as speed, size, load, type and state of propulsion system, and meteorological and oceanographic conditions, such as sea surface and currents (MacGillivray et al.,2018)

For support vessels, the noisiest anticipated activity is when the vessel uses thrusters to maintain its position. McCauley (1998) measured underwater sound pressure levels equivalent to approximately 182 dB re 1 µPa @ 1 m with a frequency range of 20 Hz to 10 kHz fr.om 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; e.g. McCauley (1998) measured underwater sound levels from the Pacific Ariki, a 64 m long support vessel with 8000 HP (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.

More recently, Koessler and McPherson (2020) modelled underwater sound levels from an offshore support vessel (OSV) in 90 m of water, with underwater SPL of 183 dB re 1 µPa @ 1 m whilst operating all three thrusters. The modelling indicated that thruster noise dropped below 120 dB re 1 µPa within 4 to 5 km. 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, e.g. inspection and maintenance activities will typically require the vessel to be moving slowly at around four knots.

6.2.1.2 Noise generated from ROVs

ROVs may be used during activities associated with IMMR and CoP activities. ROV activity will be undertaken from a vessel and the noise generated will typically be of considerably lower intensity than vessel noise.

As underwater sound levels are dependent on the primary (noisiest) sound source rather than being strictly additive, and since ROV operations will be undertaken from a vessel, they will make little contribution to the overall noise emissions associated with vessel activities, as described above and are not risk assessed further

6.2.1.3 Single-beam and multi-beam echo sounders and side-scan sonar

Side scan sonar (SSS), single-beam echo sounders (SBESs) and multi-beam echo sounders (MBESs) are used to develop high-resolution images of the seafloor or objects on the seafloor such as subsea infrastructure. Sound

pressure levels for SBESs and MBESs typically range from 210 to 245 dB re 1 µPa @ 1 m, and SSS typically range from 220 to 226 dB re 1 µPa @ 1 m (DECC, 2011).

A modelling study completed in 2013 (Zykov, 2013) indicated the maximum distances at which sound pressure levels were reduced to just above background level (120 dB re 1 µPa) from different equipment types. These were:

- MBES: Approximately 1 km from the sound source
- SBES: Approximately 350 m from the sound source
- SSS: 1.5 km from the sound source.

SDES, MBES and SSS used for surveys have the potential to cause some temporary behavioural disturbance to marine fauna, however noise levels are well below injury thresholds. Due to the short duration chirps, the temporary and intermittent use and the mid-frequencies used by positioning and survey equipment, the acoustic noise from the survey equipment is unlikely to have a substantive effect on the behavioural patterns of marine fauna.

6.2.1.4 Sub-bottom profiler

The output from boomer SPB systems is highly dependent on the model and operational power levels. Measurement of an Applied Acoustics AP3000 boomer SPB operating at both 750 and 1000 J, is reported in Martin et al.,(2012). This boomer had a primary frequency range of 100 to 1000 Hz. During the study, the acoustic data were collected as close as 8 m to the source and directly below it. The data showed that the broadband source level for the system was 203.3 dB 1 µPa @ 1 m SPL over 0.2 ms window length and 172.6 dB re 1 μPa^2s @ 1 m SEL. They found that even with the closest measurement at 8 m, SPL values never exceeded 175 dB re 1 µPa, with the distance to 160 dB re 1 µPa calculated to be 12 m, and the unweighted accumulated SEL over an entire measurement track (525 impulses) in 28 m of water which passed directly over the recorder while operating at 1000 J was 161.5 dB re 1 μPa^2s.

6.2.1.5 Noise generated from helicopters and UAVs

Sound traveling from a source in the air (e.g. a helicopter) to a receiver underwater is affected by both in-air and underwater propagation processes, which are further complicated by processes occurring at the air-seawater 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 typically low frequency and 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°. The noise from the flyover of a Bell 214 helicopter (stated to be one of the noisiest) has been recorded underwater and was audible underwater for only 38 seconds at 3 m depth and 11 seconds at 8 m depth (Richardson et al.,1995). Noise levels reported for Bell 212 helicopter during fly-over are 162 dB re 1 µPa and for Sikorsky-61 is 108 dB re 1µPa at 305 m (Simmonds et al.,2004). It is expected that underwater sounds as a result of helicopter activity will only be for very brief periods during landing and take-off.

Noise generated by the use of UAVs will be generated above the sea surface. The noise emitted by UAVs and which penetrates the sea surface is less than the noise generated by support vessels which the UAV is launched from and the UAV operators will be on. In this way the impacts of noise from the UAV underwater are considered negligible comparatively. The noise (and presence) of the UAV is likely to result in short term intermittent behavioural responses from seabirds.

6.2.1.6 Noise generated from terrestrial activities

Vehicles and onshore use of drones have been identified as a source of noise emissions, which may constitute a source of environmental risk resulting in behavioural disturbance to terrestrial fauna. Activities relevant to the operational area will relate to onshore pipeline corridor inspections. Inspections may be conducted intermittently to inspect the integrity of the pipeline and signage (Section 2.4). Impacts are expected to be localised to the immediate vicinity of the vehicle or drone and potentially cause behavioural avoidance response. The response is expected to pass once the vehicle or drone leaves the area. Due to the intermittent nature and short timeframes of these inspections, no significant impact to species is expected.

Any drone use for the project both onshore and offshore will be conducted lawfully in compliance with applicable State and Federal legislation and licensing requirements, including adherence to separation distances.

6.2.2 Nature and scale of environmental impacts

Potential receptors: marine mammals, marine turtles, fish and sharks; terrestrial species

Noise generated from operational activities may result in physiological or behavioural impacts to fauna including marine mammals, marine turtles, fish and sharks, seabirds and terrestrial fauna (from drones). Activities that are expected to generate noise are described in Section 2.5 and include operation of IMMR vessels and geophysical survey equipment as well as use of drones during IMMR activities. These impacts include but are not limited to:

- Attraction
- Localised avoidance
- Increased stress levels
- Disturbance, leading to behavioural changes or displacement from areas
- Masking or interference with other biologically important sounds such as communication or echolocation (used by certain cetaceans for location of prey and other objects)
- Secondary ecological effects that may occur as a result of an effect on one (or more) species influencing another species; e.g. by alteration of a predator–prey relationship
- Physical injury to hearing or other organs (temporary threshold shift [TTS] or permanent threshold shift [PTS])
- Disruption to communications (particularly for cetaceans).

Impacts to marine fauna will depend on the frequency range and intensity of the noise produced, distance from the noise source, and species sensitivity. The potential impacts to each receptor are described in Section 6.2.1.1 to Section 6.2.1.6 and are discussed in terms of vessel noise during IMMR activities and survey noise during IMMR activities (which are the two main sources of noise associated with the proposed activities).

The nature and scale of impacts must be considered in the context of the ambient noise environment. Ambient underwater noise levels are dependent on location, and are often dominated by local wind noise, waves, biological noise and ship traffic. Wind speed and seabed conditions have a clear influence on the ambient noise level. Coral reefs are one of the noisiest habitats in the ocean, with sources such as breaking swells, snapping shrimp and fish choruses (Amoser and Ladich, 2005). Broadband levels on reefs are typically 95–110 dB re 1 µPa with a high proportion of low frequency noise (Tolimieri *et al.,* 2000). Fish choruses are capable of raising background noise levels to 120–130 dB re 1 µPa (McCauley, 2011). Baseline noise levels in the Otway Basin, Victoria, were measured to oscillate between 94–99 dB re 1 µPa.).

Activities may involve MBES, SSS and SBP, which all use underwater acoustic techniques. These sound sources are both non-impulsive (vessel) and impulsive (MBES, SSS and a boomer SBP), and thus require the consideration of different criteria to assess their potential impact, and thus require the consideration of different criteria to assess their potential impact.

Marine fauna respond variably when exposed to underwater noise from anthropogenic sources, with effects dependent on a number of 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 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 may occur when there is a reduction in audibility for one sound (signal) 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 frequency of the noise, as marine animals will only respond to acoustic signals they can detect, as well as the intensity of the noise. 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 the sound is received by an animal affects the nature and extent of responses to a stimulus. The threshold for elicitation of behavioural responses depends on received sound level, as well as 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 in the form of a temporary threshold shift (TTS) from which an animal recovers within minutes or hours, or a permanent threshold shift (PTS) from which the animal does not recover.

Available threshold criteria associated with behavioural and physiological impacts for sensitive receptors have been derived from a number of sources (NMFS, 2018; NMFS 2013; Popper *et al.,* 2014). These criteria have been compared with measured and predicted sound levels for different sound sources to assess potential impacts.

6.2.2.1 Marine mammals

No known aggregation, resting, breeding or feeding areas for cetaceans lie in close proximity to the operational area. However, cetaceans may travel through the area, with the operational area being within the migration BIA for the humpback whale. The relevant species are described in Section 3.2.7 and Appendix C and includes both low (LF) and mid-frequency (MF) cetaceans, through applying the appropriate classifications to baleen whales and odontocetes which may occur in the area.

Table 6-3 and Table 6-4 detail receptor noise impact and behavioural thresholds for continuous noise (vessels) and impulsive noises (survey equipment).

Impulsive noise

Exposure to impulsive noise may be more hazardous to hearing than continuous (non-impulsive) noise. SSS, MBES and SBP produce impulsive noise source anticipated for the activity. Thresholds that detail receptor noise impacts and behavioural response for impulsive noise is detailed in Table 6-3.

Table 6-3: Impulsive noise: Unweighted SPL, SEL24h, and PK thresholds for acoustic effects on marine mammals

Hearing Group	NOAA (2019)	NMFS (2018); Southall et al. (2019)			
	Behaviour	PTS onset thresholds (received level)		TTS onset thresholds (received level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL24h (LE,24h; dB re 1 µPa2·s)	PK (Lpk; dB re 1 µPa)	Weighted SEL24h (LE,24h; dB re 1 µPa2·s)	PK (Lpk; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224

A measurement study from Martin et al. (2012) indicates that the threshold for behavioural disturbance (Table 6-4) could be exceeded within less than 10 m. PTS and TTS due to SEL is not predicted to occur, considering that a measurement of along a trackline with a closest point of approach of 4 m did not result in accumulated unweighted levels higher than 121.5 dB re 1 µPa^{2}s. PTS and TTS considering PK is unlikely to occur given the measurement of 170 dB re 1 µPa PK at 40 m. Therefore, considering both SEL and PK metrics within the criteria (Table 6-4), PTS and TTS due to the MBES are not actually predicted to occur.

The sound levels from SSS are described in Section 6.2.1.3. The measurement study Austin et al. (2013) indicates that the threshold for behavioural disturbance (Table 6-4) could be exceeded within less than 130 m for marine mammals present within the highly directional source output beam pattern. The reported per-pulse sound levels at 40 m are similar to those from the MBES, and as it is not predicted to exceed either the PTS or TTS criteria considering both for both SEL and PK metrics (Table 6-4), neither is the SSS. Additionally, the per-pulse peak pressure source level of the SSS is below the PK criteria threshold, therefore the criteria cannot be exceeded and PTS and TSS impacts are not predicted to occur.

The sound levels from an SBP system is described in Section 6.2.1.4. The modelling results from McPherson and Wood (2017) and Wood and McPherson (2019) indicates that the threshold for behavioural disturbance (Table 6-4) could be exceeded within less than 145 m for the boomer, the louder of the two SBP systems. PTS due to SEL is not predicted to occur, although the SEL24h threshold for TTS could be exceeded within 10 m of the source. None of the PK metric criteria (Table 6-4) are exceeded.

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) 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. Survey and positioning equipment could cause masking of vocalisations of cetaceans due to the overlap in frequency range between signals and vocalisations. However, due to the limited propagation range of the relevant frequencies (higher frequencies attenuate rapidly), the range at which the impact could occur will be within hundreds of meters. The masking will apply to cetaceans for the positioning equipment, MBES, and SSS, with all signals above 2 kHz. The boomer SBP could potentially mask

vocalisations from LF cetaceans, as it has a primary frequency range from 100 to 1000 Hz, however the low source levels mean the affected distances are expected to be within hundred to low thousands of meters.

Behavioural response to acoustic exposure is generally variable, context-dependent, and less predictable than the effects of noise exposure on hearing or physiology. Hence, it is difficult to determine thresholds for behavioural response in individual cetaceans as the way they respond often varies (Nowacek et al., 2004, Gomez et al., 2016, and Southall et al., 2019) and is influenced by both biological and environmental factors such as age, sex and the activity at the time. Observed disturbance responses to anthropogenic sound in cetaceans include altered swimming direction; increased swimming speed including pronounced 'startle' reactions; changes to surfacing, breathing and diving patterns; avoidance of the sound source area and other behavioural changes.

Non-impulsive noise

For non-impulsive noise, the US National Marine Fisheries Service (NMFS) currently uses 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 (NOAA 2019) whilst for impulsive noise, NMFS uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) (NOAA 2018, NOAA 2019). The behavioural disturbance threshold criteria applied summates the most recent scientific literature on the impacts of sound on marine mammal hearing and is therefore considered the most relevant to this activity.

Behavioural responses from aircraft have been observed as follows:

- Reactions of cetaceans to circling aircraft (fixed wing or helicopter) are sometimes conspicuous if the aircraft is below an altitude of 300 m, uncommon at 460 m and generally undetectable at 600 m (NMFS 2001).
- Baleen whales sometimes dive or turn away during overflights, but sensitivity seems to vary depending on the activity of the animals. The effects on cetaceans seem transient, and occasional overflights probably have no long-term consequences on cetaceans.

These responses are relevant to understanding the potential impacts of helicopter operations within the operational area.

The EPBC Act–listed species expected to be within or move through the operational area or a 20 km radius and therefore potentially be impacted by underwater noise are listed in Section 3.2.7. These include four threatened species the sei whale (vulnerable), blue whale (endangered), fin whale (vulnerable), Australian snubfin dolphin (vulnerable), Australin humpback dolphin (vulnerable) likely to occur in the operational area with several migratory species (likely to transit the operational area (Bryde's whale humpback whale, killer whale and spotted bottlenose dolphin and dugong). Conservation Management Plan for the Blue Whale, 2015–2025 (Commonwealth of Australia, 2015) Conservation Advice for *Orcaella heinsohni* (Commonwealth of Australia, 2025) and the Conservation advice for Balaenoptera physalus (fin whale) (2015) identifies noise interference as a risk. They require that risk of noise interference is evaluated and, if required, appropriate mitigation measures are implemented. 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 expected. The Conservation Management Plan for the Blue Whale requires that anthropogenic noise in distribution areas will be managed such that any blue whale continues to utilise the area without injury. As injury is not expected as a result of continuous sound sources resulting from the activity, impacts will be managed in adherence with the Management Plan. The National Recovery plan for the Southern Right Whale also listed anthropogenic underwater noise from vessels as a potential threat to the Southern Right Whale. As the Southern right whale BIA lies outside the EMBA and is 240 km from the operational area, no impacts to Southern Right whales as a result of vessel noise are expected.

Table 6-4: Continuous noise: Acoustic effects of continuous noise on marine mammals: unweighted SPL and SEL_{24h} thresholds

Hearing Group	NOAA (2019)	NMFS (2018); Southall et al. (2019)	
	Behavioural	PTS onset thresholds (received level)	TTS onset thresholds (received level)
	Sound Pressure Level (SPL) (L_p; dB re 1 µPa)	Weighted SEL24h ($LE_{,24h}$; dB re 1 µPa2·s)	Weighted SEL24h ($LE_{,24h}$; dB re 1 µPa2·s)
Low-frequency cetaceans	120	199	179
High-frequency cetaceans		198	178

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) 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. 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 masking. The potential for masking and communication impacts is therefore classified as high near the vessel (within tens of metres), moderate within hundreds to low thousands of metres (Clark *et al.,* 2009).

There is a potential for auditory masking impacts to marine mammals due to vessel noise, however impacts are considered temporary and localised because the marine fauna and the survey vessel will be almost constantly moving and therefore no single area will be impacted for any length of time.

The estimated distances to behavioural and physiological thresholds (as listed in Table 6-4) for marine mammals are provided in Table 6-5.

Table 6-5: Estimated distances to behavioural and physiological thresholds (as listed in Table 6-4) for marine mammals from vessels

Potential Marine Fauna Receptor	Estimated Distance	Justification
PTS†		
LF cetaceans	12 m	Based upon accumulation of unweighted SEL over 24 h for a vessel with a source level of 166.3 dB re 1 µPa (SPL), and applying practical spreading loss, see Section 6.2.1.1
MF cetaceans and dugongs	Not predicted to occur	Not predicted to occur for vessels with a significantly greater power output (McPherson et al., 2019b)
TTS†		
LF cetaceans	266 m	Based upon accumulation of unweighted SEL over 24 h for a vessel with a source level of 166.3 dB re 1 µPa (SPL), and applying practical spreading loss, Section 6.2.1.1
MF cetaceans and dugongs	Not predicted to occur	Not predicted to occur for vessels with a significantly greater power output (McPherson *et al.,* 2019b)
Behaviour		
LF cetaceans	Within 4-5 km	Considering a vessel with a source level of 183 dB re 1 µPa (SPL) Koessler and McPherson (2020)
MF cetaceans and dugongs		

†Considered for survey vessel under dynamic positioning only, as this is the most conservative scenario.

Activities within the operational area that have the potential to generate noise will be short-term and temporary in nature.

Impacts to marine fauna are not considered significant as:

- Continuous sound sources are expected to be below the PTS onset threshold for low and high-frequency cetaceans, and will fall quickly to below the TTS onset threshold with distance from the source
- Marine mammals may show behavioural responses to noise emissions; however, this is expected to be localised (approximately 4-5 km from the support vessels)
- Impulsive sound sources are expected to be below the PTS and TTS onset threshold
- Cumulative effects from the activity and from other activities conducted in the vicinity are not expected, due to low sound levels generated by continuous noise sources
- The operational area is located within migration BIAs, however behavioural responses will be limited to within 4–5 km from the support vessels. This represents a small proportion of the overall BIAs and is unlikely to present a barrier to movement or disrupt migratory pathways or behaviour. Impacts will be managed in adherence with the Blue Whale Conservation Management Plan 2015–2025 (DotE 2015a)
- Helicopter and UAV noise will be intermittent during the activity and below the threshold for PTS and TTS

6.2.2.2 Marine turtles

There are a number of marine turtle species expected to be found within the operational area, these include the green turtle, flatback turtle, hawksbill turtle and loggerhead turtle which are all EPBC Act listed species. Additionally internesting buffer BIAs overlap the operational area for these species except for loggerhead turtle.

The Recovery Plan for Marine Turtles in Australia (DoEE 2017) highlights noise interference from anthropogenic activities as a threat to marine turtles. The plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure to which may lead to

avoidance of important turtle habitat. whilst for impulsive noise, NMFS uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) (NOAA 2018, 2019).

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. Popper et al. (2014) suggested thresholds for onset of mortal injury (including PTS) and mortality for sea turtles and, in absence of taxon-specific information, adopted the levels for fish that do not hear well (suggesting that this likely would be conservative for sea turtles).

Finneran et al. (2017) proposed revised thresholds for sea turtle injury and hearing impairment (TTS and PTS). Their rationale is that sea turtles have best sensitivity at low frequencies and are known to have poor auditory sensitivity (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 fishes than to marine mammals (Popper et al., 2014).

Studies show that behavioural responses such as an increase in swimming activity occurred with received sound levels of approximately 166 dB re 1 µPa and an avoidance response and behaving erratically occurred at around 175 dB re 1 µPa (McCauley et al., 2000). These levels overlap with the sound frequencies produced by support vessels. Based on the limited data regarding noise levels that illicit a behavioural response in turtles, the lower level of 166 dB re 1 µPa level drawn from 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 sound sources are shown in (Table 6-7). SSS equipment are considered impulsive sources for this assessment, therefore the criteria from Popper et al. (2014) for seismic airguns, an impulsive source, has been adopted (Table 6-7).

Table 6-6: Continuous noise: Criteria for vessel noise exposure for turtles

Potential Marine Fauna Receptor	Popper et al. 2014		Finneran et al. (2017) Weighted SEL_{24h} ($LE_{,24h}$; dB re 1 µPa^2·s)	
	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 three 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.

Source: Adapted from Popper et al. (2014)

Table 6-7: Impulsive noise: Criteria for impulsive noise exposure for turtles

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 three 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.

Source: Adapted from Popper et al. (2014)

Vessel noise

Based on the criteria detailed within Table 6-6 there is a low risk of any injury to marine turtles from vessel noise (Section 6.1.1). Behavioural changes, e.g. 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 meters of the vessel, and a moderate risk of masking within thousands of metres from the vessel. Turtles have not been shown to have a reliance 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 sea turtles. The 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.

Survey noise

The sound levels of the typical survey equipment are below those associated with the PK criteria for injury (Table 6-7) 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 6-7). Behavioural changes, e.g. avoidance and diving, are only predicted for individuals near the source

(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 from all sources except the boomer SBP. This is in part because the sounds from most survey and positioning equipment (except the boomer SBP) are all outside of the hearing frequency range for turtles, which for green and loggerhead turtles is approximately 50–2000 Hz, with highest sensitivity to sounds between 200 and 400 Hz (Ridgway et al., 1969, Ketten and Bartol 2005, Bartol and Ketten 2006, Bartol 2008, Yudhana et al., 2010, Piniak et al., 2011, Lavender et al., 2012, 2014). The boomer SBP could potentially mask turtle hearing, as it has a primary frequency range from 100–1000 Hz, however the low source levels mean the distances within which masking may occur for turtles will only be within hundred to low thousands of meters.

6.2.2.3 Sea snakes

There is limited information on the effects of noise on sea snakes. A current research project investigating the impacts of seismic surveys found that hearing sensitivity of sea snakes is similar to species of fish without a swim bladder (discussed below). Therefore, it is considered that there is a moderate risk in the near and intermediate distances (which extends hundreds of metres) of behavioural impacts to sea snakes, with the impacts being limited to temporary avoidance of the area.

6.2.2.4 Sharks fish and rays

All fish species can detect noise sources, although hearing ranges and sensitivities vary substantially between species (Popper et al., 2014). Sensitivity to sound pressure seems to be functionally correlated in fishes to the presence and absence of gas-filled chambers in the sound transduction system. These enable fishes 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 fishes into three animal groups comprising:

- Fishes with swim bladders whose hearing does not involve the swim bladder or other gas volumes
- Fishes whose hearing does involve a swim bladder or other gas volume
- Fishes without a swim bladder that can sink and settle on the substrate when inactive.

Thresholds for PTS and recoverable injury are between 207 dB PK and 213 dB PK (depending on the presence or absence of a swim bladder), and the threshold for TTS is 186 dB SEL_{cum} (Popper *et al*., 2014). Given there is no exposure criteria for sharks and rays, the same criteria are adopted, though typically sharks and rays do not possess a swim bladder.

Individual demersal fish may be impacted in the vicinity of the activity and tuna and billfish and other mobile pelagic species such as whale sharks may transverse the operational area. However, the operational area is not known to be an important spawning or aggregation habitat for commercially caught targeted species. Therefore, no impacts to fish stocks are expected.

The criteria defined in Popper et al. (2014) for continuous (Table 6-8) and impulsive (Table 6-9) noise sources has been adopted.

Table 6-8: Continuous noise: Criteria for noise exposure for fish

Potential Marine Fauna Receptor	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (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
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
Fish: Swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB SPL for 48 h	158 dB SPL for 12 h	(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

Note: Relative risk (high, moderate, low) is given for animals at three 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.

Source: Adapted from Popper et al. (2014)

Table 6-9: Impulsive noise: Criteria for noise exposure for fish

Potential Marine Fauna Receptor	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	> 219 dB SEL_{24h} or > 213 dB PK	> 216 dB SEL_{24h} or > 213 dB PK	>> 186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} 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
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

Note: Relative risk (high, moderate, low) is given for animals at three 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.

Source: Adapted from Popper et al. (2014)

Survey noise

Based on available criteria from Popper et al. (2014), potential impacts of survey on fish have been assessed. Impulsive noises from survey equipment could result in physiological impacts to fish located within metres of the sound source. The likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote. Given these activities are short term in nature it is unlikely that fishes and sharks would persist in the area long enough for impacts to occur.

Behavioural impacts to fish from survey equipment noise will be limited to behavioural responses within metres of the noise source. Fish (including sharks and rays) may be temporarily displaced from the vicinity of the noise emissions. The only survey equipment with energy below 1 kHz is the boomer SBP, all other equipment which operates at higher frequencies 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 meters. However, this is only relevant for the boomer SBP, as all other sources have signals outside the hearing range of most fish in the region, which reduces the risk of impact.

Vessel noise

Based on criteria developed by Popper et al. (2014) for noise impacts on fish, vessel noise has a low risk of resulting in mortality and a moderate risk of TTS impacts when fish are within tens of metres of a vessel. The most likely impacts to fish from noise will be behavioural responses. Popper et al. (2014) identified a moderate risk of behavioural impacts to fish in near (tens of metres) and intermediate distances (hundreds of metres) from the noise source. Masking could occur within thousands of metres under a worst-case scenario of vessel operations, however typically any effect will be limited to within hundreds of metres.

Continuous noise sources are below PTS and TTS criteria for fish. Considering the open-ocean location of the operational area, impacts are not considered significant based on the following:

- Noise levels from helicopters and support vessels that may cause behavioural responses are expected to generally be confined to the operational area and concentrated within a radius of a few hundred metres of the noise source.
- Noise effects to fish may result in indirect impacts to fisheries in the operational area that are restricted to moderate within hundreds of metres of support vessels, as detailed above. With the majority of the noise emissions being of short duration and of limited extent, any impact on commercial or recreational fishing is expected to be minimal.
- Masking could occur within thousands of metres under a worst case scenario of vessel operations; however, risk of masking is low and typically any effect will be limited to within hundreds of metres.
- For impulsive noise sources behavioural impacts to fish from survey equipment noise will be limited to behavioural responses within metres of the noise source. The SSS operates at higher frequencies and is unable to be heard by most fish, which further reduces the risk of impact (Ladich and Fay 2013).

6.2.2.5 Invertebrates

Underwater noise emissions from the Activity are not expected to cause a change in behaviour to benthic invertebrates.

Vessel noise

Benthic invertebrates are unlikely to be negatively impacted from noise generated from vessel operations due to the fact that vessel based activities within the pipeline corridor are intermittent and short duration with vessels not typically sitting in one location for a period of time. Additionally, there is no convincing scientific evidence for any significant effects induced by non-impulsive noise in benthic invertebrates.

Plankton, including fish eggs and larvae, and pelagic invertebrates could drift into close proximity 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. At such a localised extent, impacts would be negligible at an ecosystem or population level.

Survey noise

For impulsive noise and benthic invertebrates, the source is an important consideration in the assessment. Low frequency sources, such as the boomer SBP, can be considered for the purposes of this assessment in the context of scientific findings relevant to seismic surveys, with no other information available to suggest a more appropriate alternative. Therefore, for the boomer SBP, impulsive noise, the sound levels defined in Day et al. (2016) and Payne et al. (2008) are considered appropriate to guide an impact assessment (Table 6-10).

Table 6-10: Impulsive noise: Sound levels relevant to invertebrates

Receptor	Sound levels
Invertebrates: effect at the seafloor (Day et al. 2016)	186–190 dB SEL 192–199 dB SEL_{24h} 209–212 dB PK-PK
Invertebrates: no effect at the seafloor (Payne et al. 2008)	202 dB PK-PK

Site specific modelling was not conducted against these thresholds for the proposed geophysical activities. However, the Beach Energy Otway Basin Geophysical Survey acoustic modelling, Wood and McPherson (2019), did undertake modelling. This work, as described above, was in similar water depths and geological environment, therefore the results can be used to conduct a high-level comparative assessment. The site-specific study in the Otway found that none of the sound levels listed in Table 6-10 were exceeded. This result is estimated to be appropriate for IMMR activities within the DC operational area.

The infrequency and short duration of surveys during IMMR are expected to reduce the potential for impact on plankton and invertebrates. Any negative impacts 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 the assessment of the potential impacts from high-frequency sources such as SSS or MBES 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. However, any negative impacts 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.

6.2.2.6 Seabirds

Seabirds are unlikely to be directly affected by underwater noise generated during operations. Due to the distance of DC supply pipeline from any seabird nesting colonies (the closest area being the Dampier Archipelago, 10 km away), the potential for airborne noise from support vessel activities and drones to cause disturbance to seabirds is extremely low.

6.2.2.7 Terrestrial fauna

Onshore operations may require vehicles to be driven near the buried pipeline or for drones to be flown over the pipeline. However, the majority of activities associated with the pipeline, where terrestrial fauna are expected to be located, will be conducted using a pig and will therefore not be detected by terrestrial fauna. Furthermore, any activities requiring vehicles or drones would be short term and temporary in nature and are not expected to be significantly different, in terms of noise, from other activities that occur in the area i.e. vehicles using 40-mile road. On this basis only minor, intermittent avoidance behaviour may be observed from time to time.

6.2.2.8 Socio-economic

Impacts to fish may result in indirect impacts to fisheries in the operational area, with impacts restricted to moderate within hundreds of meters of the vessel as detailed above. With the majority of the noise emissions being of short duration and of limited extent, any impact on commercial or recreational fishing is expected to be minimal.

6.2.3 Environmental performance objectives and control measures

The environmental performance objective (EPO) relating to this event is:

- No injury or mortality to EPBC Act and WA *Biodiversity Conservation Act 2016* listed fauna during activities [EPO-DC-01].

The control measures considered for this event are shown in Table 6-11, with environmental performance standards (EPSs) and measurement criteria for the EPO described in Table 8-2.

Table 6-11: Control measures evaluation for noise emissions

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-03	Procedure for interacting with marine fauna	Administrative	Reduces risk of physical and behavioural impacts to marine fauna from vessels, helicopters and drones because if they are sighted, vessels, then the vessel can slow down or move away	Operational costs to adhere to marine fauna interaction restrictions, such as vessel and drone speed and direction are based on legislated requirements and must be accepted.	**Adopted** – Benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos.
DC-DM-04	Prestart Requirements (for survey equipment).	Administrative	Potential reduction in impact of noise to some sensitive receptors based on principles of the EPBC Policy Statement 2.1 – Part A.	Impracticable to schedule activities to avoid all listed marine fauna due to variability in timing of environmentally sensitive periods and the constant or unpredictable presence of some species. Short duration activity (i.e. a few days)	**Adopted** – Where practical (i.e. where equipment allows) as benefits in reducing potential impact to fauna from noise.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
				that is low risk to marine fauna.	
DC-CM-05	Vessel Planned Maintenance System	Administrative	Ensures equipment which generates noise is operating optimally and sound sources levels are appropriately verified and within desired operating range.	Costs are standard for routine PMS.	**Adopted** – Benefits in reducing noise impacts.
Additional Controls					
N/A	Dedicated Marine Fauna Observer on vessels (as per EPBC Policy Statement 2.1 – Part B.1)[1]	Protective	Improved ability to spot and identify marine fauna at risk of impact by vessel noise.	Additional cost of contracting several specialist Marine Fauna Observers while the risk to all listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species.	**Rejected –** Cost disproportionate to increase in environmental benefit, and given that crew members will be observing for marine fauna during vessel activities.
N/A	Schedule operational activities to avoid coinciding with sensitive periods for marine fauna present in the operational area.	Administrative	Reduce risk of impacts from noise emissions during environmentally sensitive periods for listed marine fauna. Potential reduction in impact of noise to some sensitive receptors.	High cost in moving or delaying activity schedule. The risk to all listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species. Impracticable to schedule operational activities to a limited time of the year as this would affect the maintenance program and integrity of the assets, leading to potential critical safety and environment impacts.	**Rejected** – Given the minimal risk of impacts to threatened species (e.g. whales, and turtles) occurring, the financial and environmental costs of amending the activity schedule to suit multiple sensitivity windows is deemed grossly disproportionate to low environmental benefits. Cost and residual safety risk is disproportionate to increase in environmental benefit.
N/A	Undertake site specific acoustic modelling.	Administrative	Increase the knowledge of potential impacts.	Additional cost to undertake site specific acoustic modelling.	**Rejected** – Noise emissions from geophysical surveys are already reasonably well documented. Cost is disproportionate to increase in

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
					environmental benefit.
N/A	Shutdown zone of 500 m will be enforced during MBES, SBES and SSS activities consistent with EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration.	Isolate	Would prevent noise from MBES, SBES and SSS activities occurring within potentially harmful distances of marine fauna that are observed prior to commencement and during geophysical activates using MBES, SBES and SSS.	Additional cost of contracting specialist marine fauna observers while the risk to all EPBC Act listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species. The control also relies on marine fauna being observed and would not benefit all sensitive species.	**Rejected** – This control is not considered appropriate given the nature of the geophysical surveys to be undertaken. The geophysical surveys utilise low energy equipment that is not comparable to commercial seismic survey equipment. Cost and implementation efforts disproportionate to increase in environmental benefit.

6.2.4 Environmental impact assessment

Receptor	Consequence Level
Noise emissions	
Threatened, migratory or local fauna	Noise generated from vessels and IMMR activities may result in physiological or behavioural impacts to marine fauna. Sensitive receptors that may be impacted include fish and sharks, marine mammals and turtles. Given that the activity will be for a limited duration, marine fauna potentially affected by underwater noise are expected to exhibit temporary avoidance of the noise source. Avoidance behaviour is likely to be localised within the area of the activity (due to small spatial extent of elevated noise) and temporary; i.e. for the duration of the activity only. Potential PTS to low-frequency cetaceans could occur within 12 m of the centre of the vessel (considering a representative vessel that is 54 m long) if the vessel and the cetacean remained in the same place for 24 hours. However, the vessel will never remain in the one position for this long, and as cetaceans are also always moving, the potential for this impact is extremely low. Although the operational area overlaps with the flatback, hawksbill and green turtle internesting buffer BIA, impacts are not expected on a population level or on turtle habitat. As the DC supply pipeline lies between two shipping lanes where vessel traffic is considered high, the addition of support vessels is not anticipated to significantly increase underwater noise in the flatback, hawksbill and green turtle internesting buffer BIA. Some behavioural response to vessel noise could occur to benthic fish communities within the operational area. The flat, unconsolidated sediment seabed of the operational area suggests there are unlikely to be any areas of particularly high abundance or diversity of fishes within this area, although it is likely that there will be some attraction of fishes to the subsea infrastructure. It is possible that whale sharks could pass through the operational area as there is a Whale shark Foraging BIA approximately 22 km from the operational area. Whale sharks within the operational area would be most likely around the time of the Ningaloo aggregation (March to May). Whale sharks would be expected to show a behavioural response only, as it is unlikely that this species would swim within close range (within metres) of high-energy sound sources (e.g. bow thrusters) or IMMR activities that could result in physiological damage. The slow working speed of vessels within the operational area further reduces the risk of any negative impacts attributable to vessel noise. The Conservation Advice *Rhincodon typus* Whale Shark (Threatened Species Scientific Committee, 2015b) identifies habitat disturbance as a risk. The expected noise levels and behavioural response are not considered to result in habitat disturbance, which is consistent with this advice. Seabirds are also unlikely to be directly affected by underwater noise generated during the operational activities. Due to the distance of the DC supply pipeline from any seabird nesting

Receptor	Consequence Level
Noise emissions	
	colonies (the closest area being the Dampier Archipelago, 10 km away), the potential for airborne noise from operational activities to cause disturbance to seabirds is extremely low. Invertebrates could be directly affected by underwater noise generated during the activity. However, any negative impacts 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. Terrestrial fauna are unlikely to be significantly affected by UAV and vehicle noise. The consequence level for fauna is considered to be I – Negligible.
Physical environment or habitat	Not applicable – No impacts to physical environments and/or habitats from noise emissions are expected.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which noise emissions are expected.
Protected areas	Not applicable – No protected areas identified in the area over which noise emissions are expected.
Socio-economic receptors	Noise levels are not expected to impact on socio-economic receptors due to their low activity level within the vicinity of the operational area. However, given the short duration of the activity, limited impacts from the noise levels emitted from the activity, the area available for the respective commercial fisheries and the area over which commercial species spawn, impacts to fisheries are considered negligible. There are no recreation zones within the area expected to be impacted by noise. The consequence level for socio-economic receptors is considered to be I – Negligible.
Pre-treatment consequence	I – Negligible
Overall worst-case consequence level	I – Negligible

6.2.5 Demonstration of ALARP

The DC supply pipeline is located away from any known marine fauna breeding, nesting, feeding or aggregation areas (RPS, 2008).

IMMR surveys are required to ensure the integrity of the DC supply pipeline is maintained as required under Pipeline Licence TPL/20. Noise emissions impacts to marine fauna due to vessel activities are expected to be minimal as the presence of cetaceans in the operational area is expected to be low, there is little to no risk of injury to whales from operation of acoustic equipment and the continued presence of various whale species in areas such as the Exmouth Basin, where high levels of commercial shipping occur indicates tolerance and/or habituation to ship noise among which support vessel traffic would be a minor and intermittent addition.

The sound levels generated by geophysical surveys are medium to high frequency and decay rapidly with distance travelled from the source, as demonstrated by Zykov (2013), with the furthest distance geophysical noise is expected to travel is less than 1.5 km.

Note that marine fauna affected in varying degrees by acoustic noise (i.e. cetaceans, turtles, sharks and fish) are all expected to avoid the source of noise. This avoidance is likely to be from a small area (due to the small spatial extent of required activities) and to be temporary; i.e. maintenance activities are planned for up to 30 days annually.

The support vessels are also expected to produce similar noise emissions to other marine vessels that frequent or transit through the vicinity of the operational area (i.e. oil and gas industry vessels).

Management controls are in place to reduce operating noise, including vessel and helicopter operational protocols, through adherence to the Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003). This requires compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 and includes controls to reduce the risk of disturbance to or collision with EPBC Act listed marine fauna. Santos has considered the actions prescribed in the Recovery Plan for Marine Turtles in Australia (DoEE 2017) when developing these controls to minimise noise impacts on marine turtles.

All support vessels will adhere to the EPBC Regulations (Part 8) to ensure that actions are undertaken to avoid cetaceans (also whale sharks) within 100 m of a vessel, and all crews will be inducted into these requirements. It is further expected that the vessel will typically emit sufficient noise for sensitive marine fauna to exhibit avoidance behaviour and move away from the activity to avoid physical impact zones.

Any behavioural impact caused by support vessel and IMMR activity noise is likely to be localised and temporary, with marine and terrestrial species expected to resume normal behavioural patterns in the open oceanic waters and onshore surrounding the operational area in a short timeframe.

Avoiding periods of higher sensitivity such as migration or nesting periods for whales and turtles (for example) is not considered feasible. The operational areas overlap with a number of BIAs for fauna: humpback whale migration that occurs across the NWS from April to December, and nesting activities for turtles species from August to April/May, this leaves a very small window of opportunity within which to conduct activities. Given the low potential impacts to individual fauna, there is not expected to be an impact at population level or significant impacts on migratory or nesting behaviours. It is considered that there are no additional practicable risk reduction measures to those described that would not provide a grossly disproportionate benefit to the environment. It is therefore considered that the legislated and industry standard control measures identified for vessel movements and IMMR activities which Santos will implement, will reduce the impact and risk to ALARP.

6.2.6 Acceptability evaluation

Is the consequence ranked as I Negligible) or II (Minor)?	Yes – Maximum consequence from noise emissions is I (Negligible).
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – IUCN principles of nearby reserves are met. EPBC Regulations Part 8. Controls implemented will minimise the potential impacts from the activity to species identified in recovery plans as having the potential to be impacted by noise emissions. Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Minimal behavioural changes are expected from operational and CoP activities based on the duration and scale of the activities and elimination of the risk such as restrictions on vessel operations within close proximity to cetaceans (and whale sharks). Therefore, the consequence has been assessed as negligible. Through adherence to Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which requires compliance with Part 8 of the EPBC regulations, consideration of EPBC Policy Statement 2.1, and regulations around drone use, the activity is considered acceptable to undertake in the area, in addition, no concerns from stakeholders (including fisheries) have been raised to indicate that the proposed activities will have any unacceptable impacts to socio-economic receptors. The activities that will generate noise are standard offshore industry practice and the potential impacts well documented. With the controls proposed including Part A of EPBC Act Policy Statement 2.1; 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, including internesting flatback turtles, are assessed to be I-Negligible and ALARP.

The Recovery Plan for Marine Turtles in Australia: 2017–2027 (DoEE 2017) highlights noise interference from anthropogenic activities as a threat to marine turtles. The plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure of which may lead to avoidance of important turtle habitat.

It specifies the following priority action related to noise, for all marine turtle stock:

- Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival.
- A precautionary approach should be applied with surveys that have the potential to cause noise interference when undertaken within internesting habitat.

Support vessels will generate underwater noise. Under normal operating conditions when the vessel is idling or moving between sites, vessel noise would be detectable over a short distance. Higher noise levels occur when the vessel is using the dynamic position system to hold station, such as during transfer operations. Overall, underwater noise levels generated during the activity are expected to be localised, and below the thresholds for PTS and TTS.

Transiting marine turtles are expected to occur within the operational area during nesting and internesting periods. However, given the proposed management measures, it is reasonable to conclude that noise emissions will not affect the conservation status of marine turtles or compromise the objectives of the marine turtle recovery plan and therefore impacts are acceptable.

The operational area overlaps BIAs for humpback whales (migration).. The Conservation Management Plan for the Blue Whale (DoE 2015) discusses marine seismic surveys and associated risk management measures, including implementing practical measures outlined in Part A of EPBC Act Policy Statement 2.1, however this is not relevant to this activity as SSS and MBES is associated with these activities and the use of these will be of a very short duration.

The controls proposed are consistent with relevant standards, including Part A of EPBC Act Policy Statement 2.1, EPBC Regulations Part 8 (Vessels and Aircraft), and aligned with the applicable management actions outlined in relevant Recovery Plans and Approved Conservation Advice. No concerns from stakeholders (including fisheries) have been raised regarding noise emissions during the activity. Therefore, the I - Negligible impacts expected from noise emissions are considered environmentally acceptable.

6.3 Light emissions

6.3.1 Description of event

Event	There is no lighting along the DC supply pipeline offshore or onshore. No 'routine' night-time activities are planned. However, if required, operations, maintenance and CoP related activities may need to be undertaken at night for the purposes outlined in this EP. Offshore maintenance activities on the DC supply pipeline using support vessels will be mainly conducted during daylight hours. Support vessels will have external lighting to facilitate navigation and safe operations if operating at night. Lighting typically consists of bright white (i.e. metal halide, halogen, fluorescent) lights, and are not dissimilar to 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*. The support vessels will be required to generate navigational lighting at night to indicate their position and they must indicate their limited ability to manoeuvre during operations under the *Navigation Act 2012*. An ROV will be used during the activity and it will require the use of spot lighting while it is underwater working. Lighting will typically consist of bright white (i.e. metal halide, halogen, fluorescent) lights. Onshore light emissions may occur as a result of onshore maintenance activities along the onshore DC supply and DC sales gas pipeline. Typically these activities are undertaken during daylight hours, with no night-time operations planned, but may be required in emergency scenarios. There are no lights along the onshore section of DC supply pipeline, so there is no light glow on Forty Mile Beach.
Extent	The light assessment boundary of 20 km from the source will be used as the extent of light exposure, in accordance with National Light Pollution Guidelines for Wildlife (DCCEEW 2023). The 20 km buffer also encompasses the extent to which seabirds may be affected which is considered to be 15 km from the light source (Commonwealth of Australia 2023) The additional 20 km buffer around the operational area is the extent relevant to the impact assessment for planned light emissions and has been subject to a separate PMST report (Appendix D). Appendix D identifies the values and sensitivities within the buffer. Table 3-10 identifies the BIAs intersected by the light assessment boundaries.
Duration	Navigational and safety lighting will be required on vessels on a 24-hour basis during routine and non-routine IMMR and CoP related activities. ROV activities are intermittent (refer Table 2.3).

6.3.2 Nature and scale of environmental impacts

Potential receptors: Threatened, migratory or local fauna (marine mammals, marine turtles, sharks, rays, fish, and seabirds).

Receptors that have important habitat present within a 20 km buffer of the operational area were considered as having potential for interaction, based on recommendations of the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023). The 20 km threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings (15–18 km) and fledgling seabirds grounded in response to artificial light 15 km away.

Artificial lighting has the potential to affect marine fauna that use visual cues for orientation, navigation, or other purposes, resulting in behavioural responses that can alter foraging and breeding activity in marine reptiles, seabirds, fish and zooplankton; create competitive advantage to some species; and reduce reproductive success and/or survival in others.

- Behaviour – many organisms are adapted to natural levels of lighting and the natural changes associated with the day and night cycle as well as the phase of the moon. Artificial lighting has the potential to create a constant level of light at night that can override these natural levels and cycles.
- Orientation – species such as marine turtles and birds may use lighting from natural sources to orient themselves in a certain direction at night. In instances where an artificial light source is brighter than a natural source, the artificial light may override natural cues, leading to disorientation.

These potential impacts depend on:

- Density and wavelength of the light and the extent to which light spills into areas that are significant for breeding and foraging
- Timing of overspill relative to breeding and foraging activity
- Resilience of the fauna populations that are affected.
- The most sensitive environmental receptors to light emissions are marine turtles and seabirds.

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of marine mammals. Marine mammals predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds et al., 2004), so light is not considered to be a significant factor in marine mammal behaviour or survival. The operational area overlaps with the migration BIA for humpback whales. Light is not listed as a threat in the Blue Whale Conservation Management Plan 2015–2025 (2015), or the Conservation advice for fin or sei whales, and impact from light to these species are not anticipated.

Lighting from the support vessels may result in alterations to normal marine fauna behaviour, as discussed below for each fauna group. The combination of colour, intensity, closeness, direction and persistence of a light source are key factors in determining the magnitude of environmental impact (OEPA, 2010).

Lighting from ROVs in the operational area may result in the localised aggregation of fish around the ROV. These aggregations of fish due to light are considered localised and temporary. These aggregations of fish, krill or plankton would be confined to a small area and would only occur when the ROV is in use. As such impacts from ROV use is not considered further

6.3.2.1 Birds

Multiple bird species or species habitat is located within the area potentially affected by light emissions. 15 threatened bird species were identified with the Curlew Sandpiper and Eastern Curlew considered critically endangered. Another 20 migratory bird species were also identified (Table 3-9).

The operational area with the 20 km light buffer also overlaps the breeding BIAs for the roseate tern, the wedge-tailed shearwater and fairy tern. No gazetted areas for nesting, roosting or resting was identified. However. in 2016/17, areas of potential wedge-tailed shearwater nesting habitat were recorded on Varanus Island (5.53 ha) and Airlie Island (12.47 ha) and surrounding islands of Bridled (2.94 ha), Serrurier (130.89 ha), Abutilon (2.02 ha) and Parakeelya (1.66 ha) (Astron 2017b).

The wedge-tailed shearwater, roseate and fairy tern do not have a recovery plan or conservation advice. The Australian Fairy Tern (sub-species *Sternula nereis nereis*) has been listed as known to occur in the operational area. The Commonwealth Conservation Advice on *Sternula nereis nereis (*Australian Fairy Tern) (2011) suggests minimising night-time lighting from oil and gas rigs near subspecies habitat to reduce night time feeding opportunities for Silver Gills and therefore discouraging competition with Fairy terns. Light has not been identified as a threat in the National Recovery Plan for the Australian Fairy Tern (*Sternula nereis nereis*) (2020), however light pollution is listed as a threat in the Wildlife Conservation Plan for Seabirds (Commonwealth of Australia 2020).

The most vulnerable life stages for seabirds and migratory shorebirds are nesting adults or fledglings. Nesting or fledgling seabirds and migratory shorebirds are vulnerable to artificial lighting within 20 km of the nesting location (Commonwealth of Australia 2020). For shearwater species, fledglings are predominantly impacted by onshore lighting sources, which can override sea finding cues and attract fledglings further inland, preventing them from reaching the sea (Mitkus et al., 2018; Telfer et al., 1987). Artificial light can also impact important behaviour of nesting adults (e.g. adult nest attendance, maintaining nest sites) or confuse shearwater species, resulting in injury or mortality as a result of birds colliding with structures (Cianchetti-Benedetti et al., 2018; Rodriguez et al., 2017).

In particular, wedge-tailed shearwaters are a nocturnally active species that breed on some of the islands of the Lowendals (including Varanus, Serrurier, and Bridled Island) and surrounding Barrow Island. They are frequently engaged in nocturnal flight in the waters surrounding the area between the months of August until April (Surman and Nicholson 2012). When the fledgling young leave their burrows at night during the austral autumn, they can become attracted and disoriented by bright artificial lights up to 20 km away (Nicholson 2002; DCCEEW, 2023).

As the activities will be conducted away from known nesting areas, at limited frequency and only for short durations, artificial light from the activities is not predicted to disrupt critical breeding behaviours within important nesting habitat, nor displace seabirds from nesting habitat.

Birds are known to be attracted to food sources that may aggregate around artificial light sources (e.g. invertebrates and fish). Support vessel lighting may attract marine life at all at all trophic levels, which creates food sources for birds (Surman, 2002).

6.3.2.2 Fish and plankton

The PMST report for the operational area with a 20 km light buffer (conservative for fish) identified Southern Bluefin Tuna, seven shark species, two rays and four sawfish species as present within the area potentially affected by light emissions. Six of these are listed as Vulnerable (Grey Nurse shark. Great White Shark, Dwarf, Freshwater and Green Sawfish and the Whale shark) while the Southern Bluefin tuna is listed as Conservation dependant (Table 3-9).

Fishes will likely not be affected by navigational lighting for mariners (Morandi et al 2018). However, other light emissions from the activity (such as deck lights for operational requirements) in the operational area may result in localised aggregation of fish in the immediate vicinity of the DC supply pipeline, support vessels and WHP. This may result in an increase in predation on prey species aggregating in the area, or exclusion of nocturnal foragers/predators from the area (Marchesan et al., 2005). Artificial light can also influence dial vertical migration patterns of plankton (including planktonic life stages of some fish species) in the surface waters and lead to migrations that occur outside of the optimal window for that species (Gibson et al., 2001, cited in Morandi 2018). The aggregation of plankton from light may result in the presence of whale sharks foraging as they are filter feeders, that primarily feed on plankton and zooplankton.

Overall, a short-term localised increase in fish activity is expected to occur as a result of lighting from the activity; however, with negligible impacts to the local fish.

6.3.2.3 Marine turtles

The PMST report for the operational area with a 20 km light buffer identified five turtle species potentially affected by light emissions including loggerhead, green, leatherback, hawskbill and flatback turtles

The operational area with the 20 km light buffer also overlaps with the foraging, internesting, mating, nesting and migration BIAs for green, hawksbill and flatback turtles as does the internesting BIA for loggerhead turtle. Of these, the nesting BIAs are considered critical for their survival (as defined by the EPBC Act).

The Recovery Plan for Marine Turtles in Australia: 2017–2027 (CoA, 2017) highlights artificial light as one of several threats 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
- Creating pools of light that attract swimming hatchlings and increase their risk of predation
- Disrupting hatchling orientation and sea finding behaviour.
- Marine turtles are particularly sensitive to artificial lighting, which is known to disrupt breeding adult turtles and post-emergent hatchlings (Limpus, 1971; Salmon and Wyneken, 1994; Limpus, 2007, 2008a, 2008b, 2009a, 2009b).

This disruption can occur because hatchlings orient themselves to the lowest elevation light horizon and away from high silhouettes when moving from the nest to the sea. When the direction of the lowest elevation light horizon is not clear, hatchlings move towards the brightest, lowest horizon (Limpus & Kamrowski, 2013).

There is little evidence of turtle activity on Forty Mile Beach. Pendoley Environmental (2009) observed one Flatback turtle track and one Flatback nest on the beach during their study. No turtles were observed onshore, however there were 11 turtles observed offshore. This included ten sightings of juvenile Green turtles and one sighting of an adult Flatback turtle. Pendoley Environmental (2007) did not observe any evidence of turtle activity either onshore or offshore during their site visit to Forty Mile Beach. Anecdotal reports of nesting on the beach are supported by a fragment of a turtle shell that was found during the site visit – however these reports suggest nesting effort on the beach is low. Strong prevailing winds may quickly erase any evidence of turtle activity or nesting effort.

Hatchlings

Turtle hatchlings emerge from the nest and orient towards the sea. After entering the water, hatchlings use a combination of cues (wave direction and currents) to orient and travel into offshore waters. Impacts to the sea-finding behaviour of hatchlings are more common for light sources behind a beach, as lighting offshore will orient emerging hatchlings towards the sea. Artificial light can also impact hatchling dispersal once they are in the water. Lighting of support vessels can create pools of light that attract swimming hatchlings and increase their risk of predation (Commonwealth of Australia, 2017). Artificial light can therefore cause a gradual decline in the reproductive output

of a nesting area, with changes not evident for decades because of the long life cycles involved (Commonwealth of Australia, 2017).

Thums et al. (2016) demonstrated the effects of artificial light on hatchlings experimentally in wild green turtle hatchlings on the North West Cap, WA where 88% of 40 tracked hatchlings affected hatchling behaviour spending 23% more time in the near shore area than control hatchlings. Extended time on the beach can lead to fatigue and reduce the success of hatchlings entering the ocean. In the near shore zone, orientation towards on and offshore light sources may cause them to remain in shallow water for longer, reducing the success of their seaward dispersion and potentially increasing their exposure to predation.

Any impacts to hatchling turtles from artificial light will be limited to possible short-term behavioural impacts that may result in a detectable but insignificant change to the local population.

Adults

Potential impacts from artificial light on interesting, mating, foraging or migrations are not well documented. As such, light emissions from the activity are unlikely to result in displacement of, or behavioural changes to individuals in these life stages (Pendoley Environmental 2020).

Artificial lighting may affect where nesting adult turtles emerge onto the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al., 1995a, 1995b; Salmon and Witherington 1995). Lighting that may induce such impacts are typically from residential and industrial development at the coastline, rather than offshore. As such, support vessels lighting is unlikely to discourage females from nesting, or affect nest site selection, and therefore is not expected to displace females from nesting habitat. As such, light emissions from the activity are unlikely to result in more than localised behavioural disturbance to isolated transient individuals, with no lasting effect to the species.

The Recovery Plan for Marine Turtles in Australia: 2017–2027 specifies the following priority actions for the Pilbara genetic stock of flatback turtles in relation to artificial light:

- Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats.

Light emissions from the activity may be visible at nesting beaches for short periods of time but are not expected to result in significant disturbance to nesting adults or emerging/dispersing hatchings from light emissions.

The potential impacts of light emissions to marine turtles from the activity are expected to be restricted to localised attraction and temporary disorientation. There will be no long term or residual impacts due to the activity being intermittent and short-term. It is considered that the activity will not compromise the objectives as set out in the Recovery Plan for Marine Turtles and the impact of lighting associated with the activity to turtles is negligible.

6.3.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- Minimise impacts to marine fauna from lighting through limiting lighting to that required by safety and navigational lighting requirements [EPO-DC-02].

The control measures considered for this activity are shown in Table 6-12, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-12: Control measures evaluation for light emissions

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-06	Navigation lighting and aids	Administrative	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	Additional costs associated with implementing control.	**Adopted** – Cost is considered acceptable for the benefit that may be realised from this control.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			potential impacts to fauna.		
DC-CM-07	Premobilisation review and planning of lighting on vessels is undertaken prior to IMMR activities commencing.	Administrative	Lighting is assessed to only provide necessary lighting for safety and navigation during the IMMR activity. Reducing the potential for additional light pollution to the environment.	Additional costs associated with implementing control.	**Adopted**– Cost is considered appropriate for the benefit that may be realised from this control.
Additional Control Measures					
DC-CM-08	Management of support vessel lighting within the operational area at night within 3 km of the shore.	Engineering	Support vessels will be required to minimise deck lights after 9pm and refrain from directing spot lights towards the water or a turtle nesting beach, unless inconsistent with AMSA Marine Orders (such as lighting required to safely accommodate night time cargo lifting operations), to minimise the potential risk of light spill disturbing marine fauna and seabirds.	Costs associated with the management of vessel lighting are negligible.	**Adopted** – the HDD Crossing location is within 3 km of shoreline and the cost of introducing these controls is considered appropriate for the benefit that may be realised from this control.
N/A	Review lighting on vessels to replace with a type (colour) that has less potential to impact.	Substitute	Reduce potential for impacts on certain sensitive receptors from light emissions.	High cost to complete lighting change out on all vessels in area of low sensitivity. Navigational lighting colours are stipulated by law.	**Rejected** – Cost considered disproportionate compared to the incremental environmental benefit and is a legislative requirement.
N/A	Use of shrouding on external lights	Protective	Reduce potential for impacts on turtles from light emissions during hours of darkness when light sources are more apparent and potential impacts are greatest.	Cost associated with retro fitting external lighting with shrouding/shielding. Can only be done for lighting that does not impact on navigational requirements or safety.	**Rejected** – Shrouding of lights would restrict the operational activity as lights are already typically inward facing and directed towards the key areas of activity.
N/A	Limit or exclude vessel-based night-time operations.	Eliminate	Reduce potential for impacts on certain sensitive receptors from light emissions during hours of darkness when	Would double duration of activity; would increase impacts or potential impacts in other areas, including increase in waste, air emissions and risk of	**Rejected** – Given the minimal risk of impacts to EPBC Act listed marine species (e.g. turtles) occurring due to lighting, the financial

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			light sources are more apparent and potential impacts are greatest.	vessel collision; would be a navigational hindrance. The risk to all EPBC Act listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species.	and environmental costs incurred by requiring all works to be undertaken during daylight hours only (therefore disrupting operational activities) is unfeasible. Although the operational area overlaps with the internesting turtle BIA, impacts are not expected on a population level or on turtle habitat.
N/A	Limit or exclude night-time operations near Forty Mile Beach during turtle nesting seasons.	Eliminate	Reduce potential for impacts on certain sensitive receptors from light emissions during hours of darkness when light sources are more apparent and potential impacts are greatest.	This would increase the time taken to conduct activities or potentially delay operational and potentially safety dependent activities.	**Rejected** – There is minimal risk to nesting turtles given the short-term, temporary nature of activities that may need to be carried out at nighttime. Furthermore, all activities would be operationally required and, in some instances, required to maintain infrastructure integrity and safety. Therefore, unacceptable risk could be introduced by having to delay activities. There is also little evidence of nesting on forty mile beach.

6.3.4 Environmental impact assessment

Receptor	Consequence Level
Light Emissions	
Threatened, migratory or local fauna	Artificial lighting may result in behavioural changes to fauna, particularly marine birds,fish and marine turtles. Impacts to marine fauna are expected to be restricted to a detectable but insignificant change to the local population through localised attraction and temporary disorientation. Lighting of support vessels can create pools of light that attract swimming hatchlings and increase their risk of predation (Commonwealth of Australia, 2017). Artificial light can therefore cause a gradual decline in the reproductive output of a nesting area, with changes not evident for decades because of the long life cycles involved (Commonwealth of Australia, 2017). However, night time activity will only be for short periods of time. Any impacts to hatchling turtles from artificial light will be limited to possible short-term behavioural impacts that may result in a detectable but insignificant change to the local population. Although the operational area overlaps with the internesting flatback, hawksbill and green turtle BIA, impacts are not expected on a population level or on turtle habitat. Cetaceans and marine mammals are not known to be significantly attracted to light sources at sea; therefore, disturbance to behaviour is unlikely. Indirect impacts on food sources or habitats also unlikely (see below).

Receptor	Consequence Level
	Fish, sharks and birds have been shown to be attracted to artificial light sources, however, the short duration of any maintenance activities is unlikely to lead to large scale changes in species abundance or distribution. Impacts to fish, sharks and seabirds will therefore 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. No impacts from onshore operational activities are expected due to planned activities occurring in daylight hours only. The consequence level for fauna is considered to be I – Negligible.
Physical environment/habitat	Not applicable – No impacts to physical environments and/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 – No protected areas identified in the area over which light emissions are expected.
Socio-economic receptors	Not applicable – Lighting is not expected to cause an impact to socio-economic receptors other than as a visual cue for avoidance of the area.
Pre-treatment consequence	I-Negligible
Overall worst-case consequence level	I – Negligible

6.3.5 Demonstration of ALARP

Elimination of navigation and safety lighting from support vessels at night is not considered practicable due to the legislative requirement to maintain safe navigational lighting. The alternative is for the vessel to return to shore and back to the location of the activity; this would be of no net environment benefit due to extra fuel use.

The potential to disorient or misorient turtles (nesting adults and hatchlings) through night-time support vessel lighting is considered unlikely as the location of the activity is located greater than 25 km from the nearest known significant turtle rookeries (i.e. Rosemary Island). Further, the DC supply pipeline location lies between two shipping lanes where vessel traffic is considered high; the addition of support vessels is not anticipated to increase potential predation to swimming hatchlings in the flatback turtle internesting BIA. Therefore, the environmental risk to hatching turtles and nesting adults is considered low. In addition Santos will implement vessel lighting management when in close proximity to shorelines to further reduce the potential for impact.

The activity will not compromise the objectives as set out in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017), the Wildlife Conservation Plan for Seabirds (Commonwealth of Australia 2020) or the National Light Pollution Guidelines for Wildlife (DCCEEW 2023), as biologically important behaviours of nesting females and emerging/dispersing hatchlings can continue given the short periods the activity will be conducted in the operational area and the controls implemented as described in Table 6-12.

The assessed residual consequence for this impact is negligible 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 6.3.3. It is considered therefore that the impact of the activities conducted is acceptable and ALARP.

6.3.6 Acceptability evaluation

Is the consequence ranked as I -Negligible or II -Minor?	Yes – Maximum consequence from light emissions is I - Negligible.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with International Convention of the Safety of Life at Sea (SOLAS) 1974 and the *Navigation Act 2012.* Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11, as well as EPBC Act Policy Statement 3.21: Industry

	guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with the Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Lighting of vessels is industry standard and required to meet relevant maritime and safety regulations; and lighting at night will be short durations as required.

The potential consequences of the anthropogenic light sources in the operational area are considered to be insignificant in nature and restricted to short-term behavioural impacts on low numbers of individual fauna that may be present in the operational area.

Significant impacts are not expected on fauna, including nesting turtles or hatchlings. The separation of the light sources associated with the activity from significant rookeries is consistent with the relevant actions described in the Recovery Plan for Marine Turtles in Australia (CoA, 2017). Although aggregation is known to occur within the operational area for flatback, loggerhead, hawksbill and green turtles, lighting from vessels is not expected to impact aggregating adults.

The activity is consistent with the relevant actions described in the recovery plan listed above.

No impacts to marine park values are expected. No stakeholder concerns have been raised regarding lighting for the event.

With the control measures in place, and compliance with navigational safety legislation, no significant impacts are expected, Therefore, the impacts of lighting to the receiving environment are ALARP and considered environmentally acceptable.

6.4 Atmospheric emissions

6.4.1 Description of event

Event	Greenhouse gas (GHG) emissions, such as carbon dioxide, methane and nitrous oxide, along with non-GHGs, such as sulphur oxides and nitrogen oxides, will be discharged to the atmosphere during support vessel and vehicle operations associated with IMMR and CoP, contributing to a localised reduction in air quality. Vessels may also use: • An incinerator to manage wastes; and/or • Ozone-depleting substances (ODS) in closed-system rechargeable refrigeration systems. Abrasive blasting material or a similar product may also be used in high pressure blasting of the onshore section of the pipeline (if an area needed to be excavated) for IMMR activities resulting in the release of particulate matter to the air. Vehicles also have a release of GHG emissions. ***Combustion emissions*** The operation of the vessel engines and vessel equipment will be the main contributor to the release of atmospheric emissions of GHGs, and other combustion wastes. These emissions include carbon dioxide and methane, non-GHGs, sulphur oxides and hydrogen sulphide. The volume of gas released from this equipment is not metered; the volume is calculated using the fuel gas and diesel usage as a proxy. A conversion factor is applied to this volume to convert it into tonnes of carbon dioxide equivalent. This factor is an accepted method used in annual reporting for the National Greenhouse and Energy Reporting Scheme. Note that NO_x is not contained in the gas stream and is therefore not considered further in the assessment of atmospheric emissions from the WHP. Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities. All vessels are required to comply with MARPOL air emissions regulations, by using low sulphur fuel (0.5%) and NOx emissions controls as applicable to engine age and type. The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding offshore atmosphere. Due to the volumes and highly dispersive nature of the emissions no adverse impacts to seabirds or humans are expected. As the activity will occur in open-ocean offshore waters, the combustion of fuels and in such remote locations will not impact on air quality in coastal towns, the nearest being Dampier (~41 km NW from the pipeline reaching landfall). The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere. Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities. ***Ozone-depleting substances*** Ozone-depleting substances are used in closed refrigeration systems on-board vessels. ODSs have the potential to contribute to ozone layer depletion if accidentally released to the atmosphere. These are not used, generated or discharged by vessel activity other than what is incidentally located and used in closed systems on-board vessels.
Extent	Localised: The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere.
Duration	Temporary: Intermittently around support vessels undertaking IMMR and CoP within the offshore operational area, typically less than once per year for less than one week, and a few hours onshore during regular pipeline inspections from vehicles.

6.4.2 Nature and scale of environmental impacts

Potential receptors: Physical environment (air quality and climate), birds

Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the activity, which could affect seabirds and humans in the immediate vicinity. Potential impacts are expected to be short-term, and relate to localised reduction in air quality, limited to the immediate vicinity of the emissions release. Atmospheric emission impacts are not expected to have direct or cumulative impacts on sensitive environmental receptors or be above National Environmental Protection (Ambient Air Quality) measures.

6.4.2.1 Combustion emissions

The combustion emission of GHGs can lead to a reduction in local air quality and add to the national GHG loading, which could in turn contribute to climate change. Non-GHGs may be toxic, odoriferous or aesthetically unpleasing.

Air emissions will be similar to other vessels operating in the region for both petroleum and non-petroleum activities. All vessels are required to comply with MARPOL air emissions regulations, by using low sulphur fuel (0.5%) and NOx emissions controls as applicable to engine age and type. The WHP crane and HPU as well as support vessels main engines and equipment such as pumps, cranes, winches, power packs and generators require MDO for fuel. The

quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding offshore atmosphere. Due to the volumes and highly dispersive nature of the emissions no adverse impacts to seabirds or humans are expected.

As the activity will occur in open-ocean offshore waters, the combustion of fuels and in such remote locations will not impact on air quality in coastal towns, the nearest being Dampier (~41 km NW from the pipeline reaching landfall)). The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere.

6.4.2.2 Ozone Depleting Substances

Accidental release and fugitive emissions of ODS has the potential to contribute to ozone layer depletion. Maintenance of refrigeration systems containing ODS is on a routine, but infrequent basis, and with controls implemented, the likelihood of an accidental ODS release of material volume is considered rare.

6.4.2.3 Particulate matter

Particulate matter from activities such as high pressure blasting on onshore parts of the pipeline with grit may lead to the release of particulate matter into the air which cannot be captured, so may result in accumulation on habitat or soils if not naturally dispersed through airflow.

6.4.3 Environmental performance objectives and control measures

The EPOs relating to this event is:

- Minimise impacts to air and water quality from planned discharges and emissions from activities [EPO-DC-03].

The control measures considered for this activity are shown in Table 6-13, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-13: Control measures evaluation for atmospheric emissions

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-05	Vessel planned maintenance system.	Administrative	Reduces emissions from vessels because equipment is operating within its parameters.	Operational costs and labour or access requirements of undertaking vessel maintenance.	**Adopted** – Benefits of operating equipment within operational parameters to help control emissions created by equipment outweighs the cost.
DC-CM-09	Fuel oil quality.	Substitute	Reduces emissions through use of low sulphur fuel in accordance with Marine Order 97 and excluding use of HFO and IFO	Operational costs of refuelling.	**Adopted** – Environmental benefit outweighs cost and it is a legislated requirement.
DC-CM-10	International Air Pollution Prevention Certification.	Administrative	Reduces probability of potential impacts to air quality due to ODS emissions and high nitrogen oxide and sulphur oxide emissions.	Personnel cost of ensuring vessel has current International Air Pollution Prevention Certificate or equivalent during vessel contracting procedure and in pre mobilisation audits and inspections.	**Adopted** – Benefits of ensuring vessels are compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
DC-CM-11	Ozone depleting substance handling procedures.	Administrative	Reduces probability of potential impacts	Reduces probability of potential impacts	**Adopted** – Benefits of ensuring no ODS released

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			to air quality due to ODS emissions.	to air quality due to ODS emissions.	outweighs the minimal costs.
DC-CM-12	Waste incineration management.	Engineering	Reduces the potential for emissions or particulates by ensuring only permissible waste is incinerated as per Marine Order 97.	Personnel cost of maintaining waste records and training staff.	**Adopted** – Benefit to air quality outweighs the costs and it is a legislated requirement.
DC-CM-47	Fully enclosed structure for abrasive blasting (blasting chamber).	Engineering	Reduces the potential for air emissions minimising particulates released to the air.	Cost associated with erecting blasting chamber. Reduces probability of potential impacts to air quality due to dust emissions.	**Adopted** – Benefit to air quality outweighs the costs and it is a legislated requirement.
DC-CM-53	Reporting of GHG emissions as per the NGER Scheme.	Administrative	This is a regulatory requirement.	Cost associated with implementing.	**Adopted** – NGER reporting is a regulatory requirement.
Additional Control Measures					
N/A	No use of high pressure blasting of exposed/excavated sections of pipelines for IMMR activities.	Eliminate	Eliminate the potential for airborne particulate matter.	Unacceptable increase in safety risk through not being able to complete IMMR activities.	**Rejected** – It is not feasible to eliminate this IMMR activity which would potentially impact on the integrity and safe operation of the pipeline.
N/A	No incineration during vessel-based operations activities.	Eliminate	Eliminate the potential for emissions due to waste incineration to impact air quality.	Increase in health risk from storage of waste. Increase in risk due to transfers (increased fuel usage, potential increase in collision risk, disposal on land).	**Rejected** – Health and safety risks outweigh the benefit given the offshore location. Cost associated with transporting waste to shore for landfill and/or incineration outweighs costs of onboard incineration.
N/A	Removal of all ODS containing equipment.	Eliminate	Eliminates potential of ODS emissions occurring and impacting on air quality.	Lack of refrigeration systems on-board the vessels would lead to unacceptable workplace conditions (i.e. air conditioning) and poor food hygiene standards, limiting the vessels' ability to undertake the activity. Therefore, there is no practicable alternative to the use of refrigeration. It is noted that ODSs are rarely found on vessels.	**Rejected** – Based on cost to replace all equipment and there is only a low potential for ODS releases.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
N/A	Alternative fuel type (non-hydrocarbon based) selected for all vessels and vehicles.	Substitute	Could reduce level of pollutants released to the environment during fuel combustion.	Practicable and reliable alternative fuel types and power sources for the support vessels have not been identified. If an alternative was available, vessels and vehicles have fuel specification for equipment, and change of fuel may require further modifications to equipment.	**Rejected** – Not feasible.
N/A	Use incinerators and engines with higher environmental efficiency.	Substitute	Improves air quality by more efficient burning or fuel combustion.	Significant cost in changing unknown vessel equipment.	**Rejected** – Cost grossly disproportionate to low environmental benefit (impact rated negligible).
N/A	Use green energy sources on vessels	Substitute	Reduces the GHG emissions associated with the activity.	Significant additional cost associated with contracting vessels or changing out vessel equipment. Significantly restricts the number and types of vessels available to undertake the activities, with potential impacts to schedule and timing. Alternatives such as renewable energy generators (wind and/or sun) are not viable options as they are weather-dependent and do not supply continuous base load power. The vessels will use low sulphur marine diesel as required by MARPOL.	**Rejected** – Significant costs to Santos are grossly disproportionate to the negligible environmental benefit that may be gained.
N/A	Use green energy vehicles	Substitute	Reduces the GHG emissions associated with the activity.	Significant additional cost associated with contracting vehicles or changing out vehicle equipment and installing electric vehicle charging stations. Significantly restricts the number and types of vehicles available to undertake the activities, with potential impacts to schedule and timing.	**Rejected** – Significant costs to Santos are grossly disproportionate to the negligible environmental benefit that may be gained.

6.4.4 Environmental impact assessment

Receptor	Consequence Level
Atmospheric Emissions	
Threatened, migratory or local fauna	Emissions from the activity are relatively small and will, under normal circumstances quickly dissipate into the surrounding atmosphere. Short-term behavioural impacts to seabirds could be expected if they overfly the location; they may avoid the area. No decrease in local population size or area of occupancy of species, loss or disruption of critical habitat, or disruption to the breeding cycle or introduction of disease. The consequence level for fauna is considered to be I – Negligible.
Physical environment or habitat	Vessel activity will occur in the open ocean and offshore waters, the combustion of fuels and rare ODS releases in such a remote location will not impact on air quality in coastal towns. The quantities of gaseous emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere. The highly dispersive nature of local winds (i.e. strong and consistent) is expected to reduce potentially harmful or 'noticeable' gaseous concentrations within a short distance from the vessels. Therefore, the consequence level is assessed as I (Negligible). There is potential for some residual particulate to settle on habitat reducing habitat quality, but vegetation within the corridor is not consider to be high quality and it is anticipated that any particulate matter would rapidly disperse in wind conditions. No adverse impacts to physical environments or habitats from atmospheric emissions are expected. Vehicle engine emissions will occur in a sparsely populated area and quickly dissipate into the surrounding atmosphere. The consequence level for physical environment or habitat is considered to be I – Negligible.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which atmospheric emissions are expected.
Protected areas	Not applicable – No protected areas identified in the area over which atmospheric emissions are expected.
Socio-economic receptors	As activities will occur along the DC supply pipeline in offshore waters, remote coastal waters and a remote onshore location, the combustion of fuels and ODS releases in will not impact on air quality in coastal towns. The quantities of gaseous emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere. The highly dispersive nature of local winds (i.e. strong and consistent) is expected to reduce potentially harmful or 'noticeable' gaseous concentrations within a short distance from vessels and therefore not impact on other marine users in the vicinity, or not influence local coastal settlements, such as Barrow Island, Dampier and Onslow. Atmospheric emissions will add to the global inventory of GHGs; however, they and non-GHGs are not expected to have any local environmental consequences. The consequence level for socio-economic receptors is considered to be I – Negligible.
Pre-treatment consequence	I – Negligible
Overall worst-case consequence level	I – Negligible

6.4.5 Demonstration of ALARP

Air emissions are unavoidable during activities associated with operation of the DC supply pipeline. Hydrocarbon combustion in Australian waters is permissible under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983,* reflected in the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 Annex VI requirements. The activities described will be localised and short-term, and emissions will disperse and rapidly assimilate in the NWS air shed. Further, all on-vessel combustion equipment will be maintained in accordance with the contractor's PMS to ensure these are in good working order.

Santos has adopted best practice industry standards as the primary measures for reducing the extent and degree of air quality impacts to ALARP. Vessels and on-vessel combustion equipment will be maintained in accordance with the Contractor's planned maintenance system to ensure these are in good working order.

There are no alternatives to combustion of fuels to adequately maintain the pipeline. To date there are no support vessels that offer any alternative fuel options. Where practicable, Santos will group activities into a single campaign to improve efficiency and reduce emissions as well as to improve cost effectiveness of the activities. There are no onshore controls applied for atmospheric emissions as these activities are not expected to present any significant risk of environmental impacts and the capture of residual dust particulates is not possible.

The MARPOL standards and AMSA marine orders are considered to be the most appropriate standards for support vessels to adhere to in this environment, given the nature and scale of the activities, and they are widely used by the industry. These include regulations controlling the level of NO_x and SO_x from vessel engines. Compliance with these requirements together with implementation of the controls listed above reduces the environmental impacts associated with air emissions to ALARP.

Furthermore, the DC supply pipeline is located in oceanic waters and a remote onshore location where air emissions will disperse and rapidly assimilate in the North West Shelf air shed.

It is considered that there are no additional practicable risk reduction measures to those described that would not provide a grossly disproportionate benefit to the environment. Therefore, with the control measures listed in Section 6.4.3 in place, the risks and impacts from atmospheric emissions resulting from the activities are considered to be ALARP.

6.4.6 Acceptability evaluation

Is the consequence ranked as I (Negligible) or II (Minor)?	Yes – Maximum consequence from atmospheric emissions is I (Negligible).
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with International Convention of the Safety of Life at Sea (SOLAS) 1974 and the *Navigation Act 2012.* Environmental Protection (Abrasive Blasting) Regulations 1998 Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with the Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Atmospheric emissions from vessels are permissible under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, 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 utilised industry wide, and compliance with MARPOL standards is considered to be an appropriate management measure in this case.

The overall impacts to the atmosphere and sensitive receptors are expected to be negligible if the emissions management is adhered to, and impacts from emissions that are generated by the various activities are considered to be ALARP and environmentally acceptable.

6.5 Seabed and benthic habitat disturbance

6.5.1 Description of event

Event	Disturbance to the seabed and benthic habitats could potentially occur due to: • Vessel anchoring (non-routine) • Cleaning of subsea infrastructure • Temporary subsea storage of equipment (e.g. work basket or clump weight) • Subsea maintenance and repair activities (e.g. diving, AUV survey activities, ROV operations, cutting, welding, pigging, installation, replacement or modification of subsea equipment, freespan rectification and stabilisation) • Initial placement of solid structures, deployment, retrieval or movement of equipment and ROV operations • Creation of artificial habitat because of the physical presence of infrastructure (and from currents altered by the presence of subsea infrastructure). • Seabed disturbance from environmental sampling as part of environmental monitoring (estimated to be up to 1 m² per grab sample) This may result in minor seabed disturbance, sedimentation or water quality impacts (i.e. increased turbidity).
Extent	Localised: within the operational area offshore.
Duration	During operations, IMMR and CoP activities.

6.5.2 Nature and scale of environmental impacts

Potential receptors: Benthic habitats and infauna

Operational and CoP activities may disturb seabed and benthic habitat through:

- direct physical disturbance of an area of seabed habitat, including benthic fauna, of up to around 4 m² per basket placement, mats and supports on the seabed
- direct physical disturbance to the seabed, including benthic fauna during IMMR activities such as maintenance and repair activities
- direct physical disturbance to a localised area of seabed habitat from environmental sampling (estimated to be up to 1 m² per sediment grab sample)
- indirect disturbance to benthic habitats and associated marine fauna by sedimentation
- increased turbidity of the near-seabed water column.

6.5.2.1 Damage or loss of benthic habitat and biota

Previous surveys of the substrate (RPS, 2008) indicate that the seabed around the infrastructure is mostly soft sediments that support sparse benthic (living on the seafloor) and epibenthic (living on the surface of sediments) organisms such as infauna (living within the sediment) (Section 3.2.3). Habitats include submerged hard substrate such as pavement and high relief reef areas that provide attachment points for sessile epifauna as well as perches and hiding places for mobile epifauna. The abundance and diversity of epifauna observed in these habitats markedly exceeds that found in soft sediment areas where many of the mobile species are hidden beneath the sediment. Macroalgae was found in patches between 10 and 22 km offshore along the pipeline route and small amount of seagrass is known to occur in the vicinity of the offshore pipeline route between 29 to 33 km offshore (RPS, 2008).

Depending on the location of the activity, the size of the boat, anchoring spread and type of benthic habitat, there is potential for anchoring activities to cause localised damage to benthic features. Should the habitat be disturbed from any of the above-mentioned activities, the soft sediment communities will rapidly return to their pre-disturbance state due to the continuously moving nature of the seabed sediments, which act to fill depressions and other disturbed areas. Sediments are then expected to be recolonised by infauna and to regain ecological function.

Temporary or permanent direct loss of benthic habitat and associated biota may occur during maintenance, repair and intervention activities including marine growth cleaning. During inspection or repair activities on the offshore pipeline, vessel activities could include the placement of stabilisation mattresses, rocks or grout bags on the seabed or rock bolting activities.

Given the distance from HDD to MLWM is 2.38 km, vessels will not require to access closer than 2 km to the nearest land, reducing the impact to shallow water habitats.

6.5.2.2 Colonisation of the pipeline

The offshore sections of the DC supply pipeline form an artificial habitat for native sessile fauna which may settle onto exposed surfaces. In addition, mobile native fauna such as fish and crustaceans are likely to shelter or forage around the pipeline. Activities are planned to monitor the condition of the pipeline and cleaning if required. The natural colonisation of the pipeline is not considered to present a significant impact to the environment.

6.5.2.3 Turbidity and sedimentation

Direct physical disturbance of an area of seabed habitat, including benthic fauna, of up to around 4 m² per ROV basket placement on the seabed within the operational area could occur. During placement of equipment or infrastructure on the seabed (e.g. during IMMR) could result in:

- indirect disturbance to benthic habitats and associated marine fauna by sedimentation
- increased turbidity of the near-seabed water column.

Sensitive receptors identified in the operational area potentially impacted by IMMR and CoP related activities include soft sediments and benthic fauna.

Impacts may occur from direct disturbance to the seabed or from elevated turbidity in the water column, which has the potential for slight and short-term impacts to benthic fauna through clogging of respiratory and feeding parts of filter-feeding organisms.

Physical impacts to the seabed from the continued presence of seabed infrastructure may impact on sediment-burrowing infauna and surface epifauna invertebrates, particularly filter feeders. Impacts are expected to be intermittent with ocean currents and localised to the footprint and general vicinity around the infrastructure.

The operational area does not contain any significant or unique areas of benthic habitat. As described in Section 3.2.3, the benthic habitats within the operational area are primarily soft unconsolidated sediments.

Depressions on the seabed left by the placement of equipment are expected to infill as a result of movement of sediments by water currents and by the deposition of detrital matter. Given the nature of the habitat and associated benthic communities (Section 3.2.3), recolonisation would also be expected to be rapid.

Any temporary turbidity and sedimentation associated with the retrieval of wet-stored equipment, environmental sediment grab sampling, or IMMR activities is not considered likely to cause a significant environmental impact, given the high background levels of natural sediment movement in the area, the minor disturbance caused by the activity and the short duration of the activity.

6.5.2.4 Artificial habitat creation

The presence of subsea infrastructure has the potential to act as artificial habitat or hard substrate for the settlement of marine organisms that would not otherwise be successful in colonising the area. Over time the colonisation of subsea infrastructure can lead to the development of a ‘fouling’ community, which subsequently provides predator or prey refuges, foraging resources for pelagic fish species, and artificial reefs potentially supporting fish aggregations (Gallaway et al., 1981).

The presence of structures may result in a minor increase in diversity and abundance of reef associated species such as cods and snappers, which prefer habitat of structural complexity.

6.5.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- Seabed disturbance is limited to planned activities and defined locations within the operational area [EPO-DC-04].

The control measures considered for this event are shown in Table 6-14, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-14: Control measures evaluation for seabed and benthic habitat disturbance

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-13	Planned subsea and offshore maintenance.	Administrative	Preplanning of subsea and offshore maintenance activities reduces the risk of impacts to the seabed.	Personnel costs associated with preparation of planning documentation.	**Adopted** – The environmental benefits outweigh the costs of implementing measure.
DC-CM-14	Anchoring and equipment deployment management.	Eliminate	Requires using existing Santos approved anchor locations within operational area, unless in case of an emergency, to prevent further seabed disturbance.	No additional costs to Santos other than negligible personnel costs of reviewing information in an emergency situation.	**Adopted** – No additional costs to Santos other than negligible personnel costs of reviewing information in an emergency situation.
Additional Control Measures					
N/A	Cessation of operations until all dropped objects are located and recovered.	Administrative	Would minimise potential for further disturbance due to dropped object potentially moving around on seabed causing further disturbance or long-term impacts.	Substantial additional cost to operational activities due to downtime over and above value of equipment lost. Little benefit given water depths and sparse distribution of sensitive benthic habitats in operational area.	**Rejected** – Cost outweighs the benefit.
N/A	Elimination of vessels or use of dynamic positioning for all vessels.	Eliminate	Reduces impacts to seabed from anchoring.	It would introduce increased risks for divers or equipment in the water during activities such as diver inspections or maintenance activities.	**Rejected** – Increased (transferred) risk disproportionate to environmental benefit.

6.5.4 Environmental impact assessment

Receptor	Consequence Level
Threatened, migratory or local fauna	No sensitive seabed features supporting significant fauna assemblages are expected within the defined operational area based on surveys completed in the area (Section 3.2.3). 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 to the amount of habitat available; therefore, the disturbance is not expected to affect prey availability, and therefore impacts to protected flatback turtle species will be negligible. The consequence level for fauna is considered to be I - Negligible.
Physical environment or habitat	The area of physical environment and habitat that would be impacted during the event is un-vegetated and small compared to the area of similar habitat in the wider environment, and is expected to re-establish following disturbance. As such, long-term or significant impacts to habitat values or ecosystem function are not expected. The impacts to the seabed from sampling, repair and maintenance activities would also be localised to the immediate repair location. No significant benthic habitats are known to exist in the corridor of the offshore pipeline. The dominant substrate from 15–20 km offshore was bare coarse sand of unknown depth. Between 29 and 33 km offshore, rock and coral bomboras were identified, surrounded by exposed rock pavement, with sand veneers and areas of bare sand supporting the growth of low-to-medium density seagrass (*Halophila*), *Caulerpa* and *foraminiferans* (RPS,

Receptor	Consequence Level
	2008).Therefore, it is not anticipated that any IMMR or sampling activities would have a significant effect on benthic communities (Section 3.2.3), and impacts to the area of physical environment and habitat will be minor. The consequence level for physical environment or habitat is considered to be I - Negligible.
Threatened ecological communities	Not applicable – No threatened ecological communities have been identified in the area over which seabed disturbance could occur.
Protected areas	Not applicable – No protected areas have been identified in the operational area where seabed disturbance could occur.
Socio-economic receptors	No stakeholder concerns have been raised.
Pre-treatment consequence	II – Minor
Overall worst-case consequence level	I - Negligible

6.5.5 Demonstration of ALARP

Given the distance from the HDD to the MLWM is 2.38 km and vessels will not require access closer than 2 km to the nearest land, thereby reducing the impact to shallow water habitats, the activities described within this EP must cover and be able to access all sections of exposed pipeline.

Where possible, anchoring while undertaking activities in connection with the offshore section of DC supply pipeline will only be conducted in Santos approved locations. Seabed disturbance (from maintenance activities) cannot be eliminated, as the alternative to anchoring is using thrusters to maintain position, which would introduce increased risks for divers or equipment in the water during such activities as diver inspections or maintenance activities and would also increase noise impacts. In addition, elimination of planned maintenance may potentially result in more severe environmental impacts (e.g. a hydrocarbon leak due to pipeline leak) and compromising with the safety requirements from the approved safety case.

A review of seabed surveys indicates that there are no sensitive habitats in the vicinity of the DC supply pipeline, and the habitat type present is well represented habitat that will recover should a disturbance occur. If anchoring of work vessels or disturbance of the seabed is required during planned maintenance and repair activities, the anchoring and mooring procedures during such activities will ensure that the area disturbed is minimised and the risks and impacts are ALARP.

It is considered that there are no additional practicable risk reduction measures to those described that would not provide a grossly disproportionate benefit to the environment. It is therefore considered that the control measures identified for seabed disturbance which Santos will implement, will reduce the impact and risk to ALARP.

6.5.6 Acceptability evaluation

Is the consequence ranked as as I (Negligible or II-Minor?	Yes – Maximum consequence from seabed and benthic habitat disturbance is I - Negligible
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and State Marine Reserve zoning objectives)?	Yes – No plans identified seabed disturbance like those described above as being a threat to marine fauna or habitats.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Operations, IMMR and CoP activities will result in some level of seabed disturbance; however, with consideration of the control measures in place, the worst impact is assessed as 'I - Negligible.

The activity is consistent with the relevant actions described in the recovery plans listed above.

No impacts to other marine park values are expected. No stakeholder concerns have been raised regarding the activity.

The potential consequence of seabed disturbance on receptors is assessed as I - Negligible. With the control measures in place, including compliance with industry standards and legislation, no significant impacts are expected. The impacts of seabed disturbance to the receiving environment are ALARP and considered environmentally acceptable.

6.6 Interaction with other users

6.6.1 Description of event

Event	Interaction with other users may occur as a result of IMMR and CoP related activities onshore and offshore Operations, IMMR and CoP phase related activities have the potential to interact with other marine users. Support vessels will be regularly transiting the area and, at times of maintenance, inspection and repair, may need to operate 24 hours a day and the longer duration of 30 days for IMMR activities may occur, though campaigns will likely be much shorter. No exclusion zones are in place around the existing DC pipelines (both offshore and onshore). The onshore section of the DC supply pipeline is buried parallel to a public access road (Forty Mile Beach Road). Onshore pipeline maintenance works has the potential to affect visual amenity of the area and increase vehicle traffic. The presence of the vessels supporting offshore pipeline operations could potentially result in interactions with fishers or shipping traffic within the vicinity of the vessel's route and subsequent localised and temporary impacts. The activity could potentially inhibit or be a disturbance to marine user groups including commercial shipping, fishing and other oil and gas activities. For commercial fishing licence holders, the level of interaction could lead to temporary displacement to fishing grounds.
Extent	Localised: Within the operational area of the planned activity.
Duration	Temporary and intermittent interaction with vessels when transiting the operational area and undertaking IMMR and CoP activities along the DC supply pipeline route offshore and onshore inspections via vehicles: For routine IMMR and inspections undertaken regularly and after significant events (e.g. cyclones).

6.6.2 Nature and scale of environmental impacts

Potential receptors: Socio-economic (commercial fishers and fisheries, recreational fishers, tourism, commercial shipping and petroleum activity)

The presence of support vessels has the potential to interact with commercial/recreational fisheries by reducing available fishing areas due to displacement. However, given that the pipeline has been operational for a number of years and is charted, commercial fishing operators are already aware of the pipeline and therefore know not to anchor or trawl over it. Therefore, future works along the pipeline are not expected to impact fishing activities.

6.6.2.1 Commercial fishers

Commercial fishers have been identified as relevant stakeholders and are considered to be the main marine user within the operational area. There are a number of commercial fisheries that overlap the operational area (See Section 3.2.8.1. These are summarised in Table 3-12.

An analysis of the historical fishing effort data, current fishery closures, depth range of activity, fishing methods and consultation feedback has revealed that there is a low potential for interaction with commercial fisheries. None of the Commonwealth fisheries identified in Section 3.2.8.1 are likely to be significantly active in the operational area as there has been no active commercial fishing within the operational area in the past few years; however, fisheries overlap the EMBA, and therefore fishing vessels could be encountered in low density. For state managed fisheries the 2013–2023 FishCube data (DPIRD 2023) indicated:

- The Mackerel Managed Fishery has had recent fishing activity with a recordable catch effort recorded and a vessel count of four vessels within the operational area.
- The West Australian Sea Cucumber Fishery has been identified as being active in data blocks that overlap the operational area within the last ten years, the data indicates that the fishery had catch effort recorded and a vessel count of three or less vessels within the operational area.
- The Hermit crab fishery has been identified as have three or less active fishing licences in the vicinity of the operational area. This fishery is unlikely to be active in the operational area as it is a land based hand collection fishery.
- Marine Aquarium Fish Managed Fishery has recorded up to nine active vessels within the operational area and three or less in the specimen shell managed fishery.
- No activity from the Pearl Oyster Managed Fishery, Onslow Prawn Limited Entry Fishery, Pilbara Demersal Scalefish Fisheries (includes trap and trawl fisheries), Pilbara Line Fishery, Pilbara Crab Managed Fishery,

West Coast Deep Sea Crustacean Managed Fishery, South West Coast Salmon Fishery, Abalone Managed Fishery has been recorded in the operational area.

Due to the low level of fishing effort within the operational area displacement of fisheries will be negligible.

Indigenous subsistence fishing and traditional hunting may occur in waters close to shorelines, outside of the operational area and therefore interactions with the WHP, DC supply pipeline and support vessels are not expected Ongoing consultation with indigenous users has raised no concerns about the oil and gas activity occurring in offshore waters.

6.6.2.2 Recreational fishers and tourism

There are various charter fishing companies that operate out of Dampier, fishing may occur at the Montebello Islands and Barrow Island but is not expected in the operational area.

Recreational activities such as snorkelling, diving, surfing and fishing activities are more likely to occur in shallow waters around the Dampier Archipelago and off the Dampier coast, and Forty Mile Beach is used as a recreational fishing beach and launching area, therefore some vessel interaction may be expected in the operational area.

6.6.2.3 Commercial shipping

The presence of the support vessels associated with the DC supply pipeline and WHP could impact commercial shipping. One major shipping route crosses the DC supply pipeline in Commonwealth waters (Figure 3-21).

Vessel traffic is largely confined to the two designated shipping fairways servicing Port Hedland. Other vessels within the area are commonly proceeding to and from other major ports in the area (ports of Dampier, Port Walcott, Port Hedland, Barrow Island, Varanus Island and Onslow). Should commercial vessels need to deviate from planned routes to avoid the activity vessels, this may slightly increase transit times and fuel consumption.

6.6.2.4 Oil and gas activities

The NWS is a major oil and gas hub in Australia, with several companies operating within the area. There are no oil and gas facilities within the operational area, though the Pluto pipeline transects the southwest corner of the permit area. There are a number of Santos facilities within close proximity to the operational area.

6.6.2.5 Terrestrial activities

The onshore section of the DC sales gas pipeline is buried adjacent to the Forty Mile Beach Road and the pipeline corridor has been rehabilitated. The HDD installation ensures the pipeline is not exposed until 2.38 km seaward from MLWM.

Onshore amenity issues are only likely to arise during pipeline maintenance works, where excavation of the pipeline is required. In this instance, increased vehicle traffic associated with the maintenance works would be low volume. The pipeline is offset from Forty Mile Beach Road and would not preclude public access.

Aboriginal heritage in the construction phase was managed in accordance with Aboriginal Heritage Management Plan (DC-00-RI-003). Note that while there are no routine monitoring requirements under the plan during the operations phase, ground disturbance in certain areas requires assessment by an Aboriginal heritage consultant before commencement. These areas include:

- the paddock between DCGP and the helipad
- any areas outside of the lease boundary

Given the activities described are all within the lease boundary and not in the DCGP, this infers no additional assessment required during CoP phase for DC onshore pipeline.

6.6.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- Minimise impacts on other marine users through the provision of information to relevant stakeholders such that they can plan for their activities and avoid unexpected interference. [EPO-DC-05].

The control measures considered for this event are shown in Table 6-15, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-15: Control measures evaluation for interaction with other marine users

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-06	Navigation lighting and aids.	Engineering	Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled and other marine users are aware of the presence of the vessels.	Costs of operating and maintaining navigational equipment.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-15	Navigational charting of infrastructure	Administrative	Provides a means for marine users to be aware of the presence of the subsea infrastructure.	Ensure other marine users are aware of the presence of the pipeline.	**Adopted** – Benefits considered to outweigh negligible costs.
DC-CM-16	Seafarer Certification.	Administrative	Requires appropriately trained and competent personnel, in accordance with Marine Order 70, to navigate vessels to reduce interaction with other marine users.	Costs associated with personnel time in obtaining qualifications.	**Adopted** – Benefits considered to outweigh costs and it is a legislated requirement.
DC-CM-17	Constant bridge watch on support vessels.	Eliminate	Monitoring of surrounding marine environment to identify potential collision risks with other marine users.	No additional cost – industry practice and regulated by AMSA.	**Adopted** – Industry practice, benefits outweigh cost.
DC-CM-18	Santos' stakeholder consultation strategy	Administrative	Ensures other marine users, such as commercial fishers, are aware of upcoming operations so they can plan their business accordingly.	Limited additional costs to Santos. Stakeholders time required to review consultation material and communicate with Santos.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.
DC-CM-19	No fishing from project vessels.	Eliminate	Reduce potential impacts to fisheries in the vicinity of the activity. Personnel are prohibited from recreational fishing activities support vessels.	Negligible costs.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.
DC-CM-20	Maritime notices	Administrative	Ensures that the other marine users are aware of the presence of the vessels	Cost associated with the personnel time in issuing notifications and closing out queries and responses.	**Adopted**- benefits outweigh negligible costs. Maritime requirement to issue maritime notices.
Additional Control Measures					
N/A	Manage the timing of the operational activities to avoid peak marine user periods (e.g. fishing).	Eliminate	Would eliminate potential impacts to other marine users.	Not considered feasible as marine users could potentially be in the area all year round and operational activities are required all year round. The	**Rejected** – Stakeholders in the area all year round.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
				area that other marine users are excluded from is small when compared to the area available to other marine users and there is low fishing activity in the area as evidenced through consultation.	
N/A	Eliminate the use of vessels.	Eliminate	Would eliminate potential impacts to other marine users.	Not considered feasible as support vessels are the only form of transport that can undertake the activities.	**Rejected** – Not feasible.

6.6.4 Environmental impact assessment

Receptor	Consequence Level
Interaction with Other Marine and Terrestrial Users	
Threatened, migratory or local fauna	Not applicable – related to socio-economic receptors only.
Physical environment or habitat	
Threatened ecological communities	
Protected areas	
Socio-economic receptors	The impact from activities along the pipeline in the operational area (offshore and onshore) is considered to be negligible due to the infrequent vessel and vehicle visits required for pipeline maintenance visits (approximately less than once a year). FishCube data (2013-2023) shows low level fishing effort in the operational area for a number of fisheries, however the operational area is not likely to be used for significant numbers of commercial fishers as it does not represent important habitat for targeted commercial species. A lack of natural seabed features (e.g. rocky or coral reef) indicates that recreational fishing is also unlikely to occur. The open waters in the vicinity of the DC supply pipeline do not support significant recreational or tourist activity (Section 3); therefore, impact to recreational fisheries or tourism is not expected. The onshore section of the pipeline runs parallel to a public road and tourists are observed camping and fishing on forty mile beach. Normal operations of the DC pipelines are not expected to impact users of the areas surrounding the onshore or offshore operational area. The consequence level for socio-economic receptors is considered to be I – Negligible.
Pre-treatment consequence	I – Negligible
Overall worst-case consequence level	I – Negligible

6.6.5 Demonstration of ALARP

Vessels are required for the activities described in this EP. The presence of subsea infrastructure in offshore fields is normal industry practice. The management of activities relating to interactions with other marine users is well established, understood and regulated. Given the offshore location, recreational and tourism activities are not expected to occur in the area. Impacts to commercial fishing activities are not expected, given the lack of fishing effort in the area. Impacts to commercial shipping movements are expected to be minimal

Stakeholders have been informed of the proposed CoP activity. Ongoing consultation, along with Notice to Mariners issued via notifications to Australian Hydrographic Service before commencing in-field campaigns minimise the risk of interference with other marine users.

With the controls adopted, the assessed residual consequence for this impact is negligible and cannot be reduced further. Additional control measures were considered but rejected since the associated cost or effort was grossly disproportionate to any benefit**.** Therefore, it is considered that the impact is ALARP.

6.6.6 Acceptability evaluation

Is the consequence ranked as as I (Negligible) or II - Minor?	Yes – Maximum consequence from interaction with other marine users is I Negligible.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with the International Convention of the Safety of Life at Sea (SOLAS) 1974 and the *Navigation Act 2012.*
Are risks and impacts consistent with Santos' Environmental Management Policy?	Yes – Aligns with Santos' Environmental Management Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The presence of the vessels and subsea infrastructure and undertaking IMMR activities is not expected to significantly affect other marine users, including commercial fishing operations or shipping traffic, given the:

- DC supply pipeline is marked on navigational charts and does not overlap defined shipping routes.
- short duration of the IMMR activity (around 30 days, depending on weather, equipment and operational issues)
- outcomes of stakeholder engagement did not identify any concerns by relevant stakeholders.

The impacts of interaction with other users is ALARP and considered acceptable.

6.7 Planned operational discharges

6.7.1 Description of event

Event	The are no planned operational discharges onshore. Planned discharges from support vessels within the operational area may include: ***Deck drainage*** Rainwater, washdown water and any spillages from bunded deck areas on a vessel may potentially discharge into the ocean. This water may contain trace quantities of contaminants from the deck surface such as detergents, oil and grease. ***Cooling water*** Seawater is used as a heat exchange medium for the cooling of machinery engines. Seawater is drawn from the ocean and flows counter current through closed-circuit heat exchangers, transferring heat from the vessel engines and machinery to the seawater. The seawater is then discharged to the ocean (i.e. it is a once-through system). Cooling water contains no contaminants, and the only associated impact on the marine environment will come from the increase in temperature, which will vary depending upon the vessels' engines workload and activity. ***Bilge water*** Bilge water is an almost unavoidable product of vessel operations. Bilge water that is generated in proximity to shipboard equipment (such as in the engine room) may contain residual hydrocarbons. ***Ballast water*** Ballast water is water confined in specially constructed compartments in a vessel's hold to serve as weight distribution and stabilisation material. Ballast water can contain marine pests (see Section 7.1 for controls to prevent accidental introduction of marine pests). ***Brine*** Brine generated from the water supply systems on board the vessels will be discharged to the ocean at a salinity of around 10% higher than seawater. The volume of the discharge depends on the requirement for fresh (or potable) water and will vary between the vessels and the number of people on board. The effluent may contain scale that control inorganic scale formation, such as the formation of calcium carbonate and magnesium hydroxide, in water-making plants. Other water purification chemicals such as chlorine may also be added to the potable water. Other water-making plant cleaning chemicals may be used and discharged to sea after completion of the cleaning process. ***Fire-fighting foam*** During routine testing that could occur during the activity, aqueous film-forming foam (AFFF) could be discharged from the foam tanks over each area covered by an AFFF firefighting system. It is unavoidable that some of this foam will be discharged to sea unless it is discharged within a closed bunding system. There are no planned discharges of putrescible or sewage wastes within 3nm of land (i.e. in State waters).
Extent	Localised: The small volumes of non-hazardous discharges may cause localised nutrient enrichment, organic and particulate loading, toxic impacts to marine fauna, thermal impacts and increased salinity in waters around discharge points and in the direction of the prevailing current. The environment that may be affected by operational discharges will likely be contained within the operational area and is predicted to be restricted to within around 100 m of the discharge point in the upper 5 m of the water column.
Duration	During the life of the activity and during IMMR and CoP activities.

6.7.2 Nature and scale of environmental impacts

Potential receptors: water Quality, fish (pelagic) and sharks, marine mammals, marine turtles and seabirds

The potential environmental impacts from routine vessel discharges include:

- temporary localised decline in water quality in the immediate vicinity of the discharge
- localised increase in turbidity of surrounding waters
- temporary and localised increase in sea surface water temperature
- temporary and localised increase in sea surface salinity.

The discharge of small volumes of non-hazardous wastes to the marine environment will result in a localised reduction in water quality. Discharges will be temporary (minutes to hours), localised and limited to surface waters (less than 5 m depth). The discharges are expected to be dispersed and diluted rapidly, with concentrations of wastes significantly dropping with distance from the discharge point. Changes to ambient water quality outside of the operational area are considered unlikely to occur.

Specifics of potential impacts to water quality from the discharge of operational discharges are as follows.

6.7.2.1 Physical environment

Salinity increases

The desalination of seawater results in a discharge of brine with a slightly elevated salinity (around 10% higher than seawater). Once discharged to the marine environment, the desalination brine, being of greater density than seawater, will sink and disperse in the currents. On average, seawater has a salt concentration of 35 parts per thousand (ppt). The volume of the discharge is dependent on the requirement for fresh (or potable) water and the number of people on board the support vessels.

Most marine species are able to tolerate short-term fluctuations in salinity in the order of 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.

Given the relatively low volume of discharge, low salinity increases and duration of the activity impact on water quality in the operational area is expected to be negligible. The brine discharge is not expected to contact any offshore reefs, islands, shoals or banks or marine parks.

Changes in temperature

Cooling water will be discharged from vessels at a temperature above ambient seawater temperature. Upon discharge it will be subjected to turbulent mixing and transfer of heat to the surrounding waters.

Temperature dispersion modelling shows that the water temperature of discharged water will decrease rapidly as the discharge mixes with the receiving waters, with discharged waters being less than 1°C above background levels within less than 100 m (horizontally) of the discharge point. Vertically, the discharge will be within background levels within 10 m (Woodside, 2011).

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 facilitate cooling and oxygenation of this wastewater stream before mixing with the surrounding marine environment.

Cooling water discharge to the marine environment could result in a localised and temporary increase in the ambient water temperature. This may cause alteration of the physiological processes (particularly enzyme-mediated processes) in marine biota. Given the relatively low volume of cooling water, the low temperature differential, and the open water surrounding the vessels, impact on water quality is expected to be low and short term.

The cooling water discharge is not expected to contact any offshore reefs, islands, shoals or banks, or marine parks.

Toxicity

Discharges from vessel systems may include chemicals within ballast systems, desalination, firefighting systems and residues of those used for cleaning decks.

On discharge to the marine environment, the low volumes of these types of chemicals are expected to rapidly disperse in the offshore marine environment. Hence, any potential impacts would be confined to a localised area immediately surrounding the discharge.

There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the release. Toxicity impacts to marine fauna from the release of chemicals are unlikely to eventuate because:

- strong ocean currents result in the discharge being further diluted upon release to the marine environment, so the duration of exposure of chemicals to fauna will be minimal
- deck cleaning products planned to be released to sea will meet the criteria for not being harmful to the marine environment according to MARPOL Annex V
- other products with potential to be released to the sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V; or Gold/Silver/D or E rated through OCNS; or have a completed Santos ecotoxicological risk assessment so only environmentally acceptable products are used
- potential discharges will be intermittent and temporary within the operational area.

6.7.2.2 Impacts to threatened or migratory fauna

As discussed in the sections above, the discharge extent for all planned discharges is localised, and rapid dilution is predicted to occur within the offshore waters. Marine fauna within the operational area are likely to be transient. The operational area overlaps with the whale shark foraging BIA, humpback whale migration BIA, bird BIAs, therefore these species are more likely to be encountered in the operational area. However, if contact does occur with any marine fauna, it will be for a short duration due to the rapid dispersion of the plume and the transient fauna movement,

such that any exposure is likely not of sufficient duration to cause a toxic effect. Impacts to critical habitat identified for turtles that overlaps the operational area will not be significantly modified or affected by these operational discharges due to the rapid dilution and dissipation in the open ocean waters.

Discharges may cause changes to behaviour in marine fauna (avoidance or attraction). Fishes and oceanic seabirds may be attracted to the discharge of food scraps. However, such discharges would be isolated occurrences and not in any one location, so no prolonged influence on faunal behaviour is expected. Discharges of cooling water and brine may cause avoidance behaviour in marine fauna. Given the nature of the discharges (localised, rapid dilution, intermittent), any behavioural impacts are expected to be short term and minimal.

Given the nature of discharged chemicals, the small volumes expect to be released to the marine environment and the nature of the marine environment within the vicinity of the operational area, the operational planned discharges are not predicted to have ecologically significant effects.

6.7.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- Minimise impacts to air and water quality from planned discharges and emissions from activities [EPO-DC-03].

The control measures considered for this event are shown in Table 6-16, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-16: Control measures evaluation for operational discharges

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-21	Sewage system.	Engineering	Reduces potential impacts of inappropriate discharge of sewage. Provides compliance with Marine Order 96: Marine Pollution Prevention – Sewage. No discharge of sewage in State waters	Personnel cost in ensuring vessel certificates are in place during vessel contracting and in premobilisation audits and inspections, and in reporting discharge levels.	**Adopted** – Benefits of ensuring vessels are compliant outweigh minimal costs of personnel time and it is a legislated requirement.
DC-CM-22	Marine assurance procedure	Administrative	Vessels selected and on-boarded in accordance with the Offshore Marine Assurance Procedure (SO-91-ZH-10001) to ensure contracted vessels are operated, maintained, and manned in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP.	No additional cost.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-23	Oily mixture system.	Engineering	Reduces potential impacts of planned discharge of oily water to the environment. Provides compliance with Marine Order 91 Marine Pollution Prevention – Oil.	Time and personnel costs in maintaining oil record book.	**Adopted** – Benefits of ensuring vessels are compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
DC-CM-24	Waste (garbage) management procedure	Administrative	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible waste disposal conditions and limitations. Provides compliance with Marine Order 95 (Marine pollution prevention – garbage).	Personnel cost of pre-mobilisation audits and inspections, and in reporting discharge levels.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
DC-CM-25	Deck cleaning product selection.	Substitute	Improves water quality discharge (reduces toxicity) to the marine environment. In accordance with Marine Order 94 those deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment.	Personnel costs of implementing. Potential additional cost and delays of deck cleaning product substitution.	**Adopted** – Benefits of ensuring vessels are compliant and that those deck cleaning products planned to be released to sea meet Marine Order 94 criteria outweigh the cost.
DC-CM-26	Chemical selection procedure.	Administrative	Aids in the process of chemical management that reduces the impact of liquid discharges to sea. Only environmentally acceptable products are used.	Cost associated with implementation of procedure. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted** – Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.
DC-CM-27	General chemical management procedures.	Administrative	Reduces potential for inappropriate discharge of water at sea, through appropriate handling, to maintain planned discharges to sea meet the criteria	Personnel time associated with vessel inspection and implementation.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			for not being harmful to the marine environment.		legislated requirement.
DC-CM-28	Scupper plugs will be available for deployment in the event of a spill to prevent deck drainage.	Engineering	Reduces the risk of spills and leaks (discharges) to sea on vessels through use of scupper plugs or equivalent deck drainage control measures available where chemicals and hydrocarbons are stored and frequently handled.	Additional personnel costs of ensuring procedures in place and followed.	**Adopted** – Benefits of ensuring procedures are followed outweigh costs.
Additional Control Measures					
N/A	Scupper plugs on support vessels are continuously in place to prevent deck drainage.	Isolation	Would eliminate potential impacts of contaminants being discharged to sea in rainwater.	Increased health and 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 benefit given small volumes of contaminants.
N/A	Mandatory closed drain system on support vessels to prevent deck drainage discharged overboard.	Isolation	Would prevent the release of deck spills to sea and therefore reduce environmental impact.	Increased cost due to treatment system required, modifications to vessels, storage space required for containment of drained liquids, increase in transfers to vessels resulting in increased potential impacts and risks. Increased transfers results in increased fuel usage, increased safety risks to personnel during transfer (e.g. crushing between skips), and increase in crane movements.	**Rejected** – Cost outweighs the benefit given the low impact expected from planned discharges and high potential impacts from the increased transfers required.
N/A	Discharge point for cooling water discharges, restricted to above sea level to allow it to cool further before mixing at sea surface.	Engineering	Reduce potential impacts associated with discharge of higher temperature water into the marine environment.	High costs to alter all current vessels to allow for discharge of cooling water at different height, not feasible on all vessels, and reduction in temperature would be minimal compared to cost of altering the discharge height.	**Rejected** – Cost outweighs the benefit given the low impact expected from planned discharges.
N/A	Store liquid wastes and transport to land.	Elimination	No discharge to the marine environment.	This would result in an increase in environmental impacts through	**Rejected** – This would result in an increase in environmental

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
				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) of the wastes.	impacts onshore and higher risk to the safety of personnel.
N/A	Zero discharge of bilge water	Eliminate	Would eliminate potential impacts of contaminants being discharged to sea from oily water.	Costs associated with containment and onshore disposal; space required for additional containment on primary vessels could create hazards for working on deck by limiting available space.	**Rejected** – Safety considerations regarding containment outweigh the environmental benefit, given the small volumes of contaminants. Discharge of treated oily water to sea is permitted maritime practice.
N/A	Zero discharge of cooling water	Elimination	Eliminates risks to receiving environment associated with deteriorating water quality as a consequence of activity cooling water by avoiding requirement to discharge.	Increased fuel consumption and increased atmospheric emissions, associated with vessel transit to port 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 on land.	**Rejected** – Cost associated with fuel and emissions disproportionate to risk and costs of discharging within approved conditions.
N/A	Zero discharge of brine water	Eliminate	Would eliminate potential impacts from brine discharges by storing on-board for onshore disposal.	Cost associated with transporting waste brine water; space required for additional containment on vessels could create hazards for working on deck by limiting available space.	**Rejected** – Cost grossly disproportionate to environmental benefit. Limited benefit to be gained, given low impact. No detectable change in water quality expected. Water

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
					making and brine discharge permitted maritime practice.

6.7.4 Environmental impact assessment

Receptor	Consequence Level
Operational Discharges	
Threatened, migratory or local fauna	Marine fauna may transit through the area. There is also a migration BIA for Humpback whales and internesting buffer BIAs for green, hawskbill, land flatback turtles that overlaps the operational area (Section 3.2.7.1). Water quality perturbations may result in an alteration to marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds. Given the infrequency of discharges (potentially annually), and the highly dispersive waters of the NWS, impacts will be limited to short-term water quality impacts and possible temporary behavioural effects observed in fish, sharks and seabirds. The consequence level for Threatened, migratory or local fauna is I – Negligible.
Physical environment or habitat	Impacts to water quality that will be experienced in the discharge mixing zone which ranges from 0 m water depth at the shoreline to approximately 30 m at the commonwealth boundary will be localised and will occur only as long as the discharges occur (i.e. no sustained impacts); therefore, recovery will be measured in hours to days. Furthermore it is noted that discharges in shallow water are either avoided (i.e. sewage/putrescible wastes are not allowed within 3 nm of land) or are reduced in shallow waters simply through the shallow waters limiting the vessel accessibility in shallow areas. Any effects on water quality are expected to be within the surface waters only and have no effect on seabed receptors even in shallow waters given the operational area is within an open coastal environment as opposed to a confined area. Given the infrequency of discharges and the highly dispersive waters of the operational area with strong drift current and local scale currents (average and maximum surface current speeds of 0.30 m/s and 2.51 m/s respectively, RPS 2024)), impacts will be limited to short-term water quality impacts and possible temporary behavioural effects observed in fish, sharks and seabirds. No physical environments or habitats are identified in the area over which operational discharges are expected to disperse other than open water. The consequence level for physical environment is I – Negligible.
Socio-economic receptors	Planned operational discharges are not expected to impact on socio-economic receptors. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. In addition, no stakeholder concerns have been raised regarding this event The consequence level for these receptors is considered to be I – Negligible.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area over which planned discharges are expected.
Protected areas	Not applicable – No protected areas are identified in the area where planned discharges could affect water quality.
Pre-treatment consequence	II - Minor
Overall worst-case consequence	I – Negligible

6.7.5 Demonstration of ALARP

The generation of bilge water, brine, oily and putrescible wastes during offshore activities is unavoidable, given that manning is required on these vessels. Discharge of these wastes from vessels in Australian waters is permissible under MARPOL 73/78 Annexes enacted under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, and related AMSA Marine Orders, noting that garbage and sewage are not permitted to be discharged in State waters.

It is not practicable to limit the location and rate of brine and cooling water discharges because these discharges are from operational inbuilt engineered systems on vessels that would in many cases require retrofitting (limiting the available field of complying vessels). Given that these discharges are considered to have negligible risk, additional controls are considered to be grossly disproportionate to the benefit gained.

The AMSA marine orders which give effect to MARPOL in Australian waters are considered to be the most appropriate standard to adhere to in this environment, given the nature and scale of the activity, and are widely accepted and used in the industry. Compliance with these requirements, together with implementation of the controls listed above, reduces the environmental impacts and risks associated with liquid waste discharges to the marine environment to ALARP.

The use of AFFF is required for emergency response purposes and routine testing the foam fire-fighting system is critical for maintaining emergency response capabilities on vessels. The product has been assessed through the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001), ensuring potential impacts are acceptable.

6.7.6 Acceptability evaluation

Is the consequence ranked as I (Negligible) or II (Minor)?	Yes – Maximum consequence from operational discharges is I- Negligible.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, 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 3-11. Yes – management consistent with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters is enacted by the Marine Orders.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Release of non-hazardous discharges into the sea from vessels in Australian waters is permissible under the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters reflects MARPOL Annex I, IV, and V requirements respectively, and is enacted by:

- Marine Order 91 (Marine pollution prevention – oil)
- Marine Order 96 (Marine pollution prevention – sewage)
- Marine Order 95 (Marine pollution prevention – garbage).

The operational discharges are not expected to significantly impact the receiving environment given the management controls proposed, including compliance with all relevant Marine Orders requirements. The Marine Orders are considered to be the most appropriate standard given that the nature and scale of the events is expected to reduce the potential for environmental impacts to a level that is considered ALARP and environmentally acceptable.

Planned operational discharges from vessels, such as bilge water, cooling water and brine, will result in short term and localised impacts; however, with consideration of the control measures in place, based on Santos' consequence matrix (Appendix G), the worst impact is assessed as 'Negligible'.

Planned wastes from operational activities onshore are to be removed from site and disposed of at an appropriate waste facility. There are no expected impacts from planned wastes from operational activities onshore.

The activity is consistent with the relevant actions described in the following recovery plans and conservation advice:

- Recovery Plan for Marine Turtles in Australia (2017)
- National Recovery Plan for Albatrosses and Giant Petrels (DCCEEW, 2022)
- Conservation Management Plan for the Blue Whale, 2015-2025

No impacts to marine park values are expected. No stakeholder concerns have been raised regarding the activity.

The impacts of operational discharges to the receiving environment are ALARP and considered environmentally acceptable.

6.8 Planned chemical and residual hydrocarbon discharges

6.8.1 Description of event

Event	Planned discharges during operations, IMMR and CoP to the marine environment include: • Discharges of metal ions from cathodic protection systems on DC supply pipeline • Discharges from maintenance activities (e.g. replacement or repair of subsea infrastructure, leak testing, fabric maintenance); • Paint and chemicals from cleaning, inspection and repair of pipelines and Discharges from cathodic protection systems on subsea pipelines Use of sacrificial anodes for cathodic protection and corrosion prevention continually releases metal ions into the marine environment at an extremely low rate as most of the ions released will supply electrons to the steel surface of the pipeline to form a protective film. Santos uses aluminium and zinc anodes for cathodic protection. ***Discharges from maintenance activities (e.g. releases during repair of infrastructure, leak testing, fabric maintenance)*** Residual hydrocarbons, corrosion inhibitor, biocides and treated seawater may enter the subsea marine environment from maintenance and operations activities. Small volumes of treated seawater will be released into the marine environment during these activities (approximately 10 m^3). Leak testing may be conducted to see if there are any integrity issues i.e. Pin holes which product can leak out of. Liquids are pushed through the pipeline and if there is a leak, there may be a release of small quantities of the liquids which is identified through the release of dye and brine. The release of dye and brine could occur at any location along the pipeline, dependant on where the leak testing is occurring. Leak testing of the subsea system may occur and result in small volumes (estimated at 10 L) of non-toxic dye released. Brine (NaCl) may also be released during this activity in small volumes. Non-routine work on. the DC pipelines) may require r the repair or replacement of equipment This type of work occurs infrequently, typically every few years. Prior to work involving repair or replacement of equipment, pipeline contents are flushed towards the DCGP with seawater containing chemicals (biocide and/or corrosion inhibitor) used to preserve the system which helps to reduce residual hydrocarbons in the pipeline. By replacing infrastructure during IMMR works, some treated seawater will be released to the marine environment with the potential for residual liquid hydrocarbons (condensate) to be associated with the discharge. However, the flushing process is designed to reduce the amount of hydrocarbons left in the system to as low as practicable. Biocides and/or corrosion inhibitor are used at a concentration required for effective preservation of the subsea system (typically 200–1,000 ppm) which is critical to pipeline integrity and safe operations. The volume of treated seawater released will vary depending on the type of maintenance or repair being performed and the capacity of the infrastructure being worked on, but the volume is anticipated to be typically in the order of 2 m^3. As with replaced equipment and infrastructure, new equipment and infrastructure may also be dosed with biocide and/or corrosion inhibitor (e.g. biocide and/or corrosion inhibitor sticks). ***Paint and chemicals from cleaning, inspection and repair of infrastructure and pipeline*** Removing corrosion, external coating or marine growth from subsea infrastructure during cleaning releases inert materials and marine growth into the marine environment, which will either fall to the seabed floor or is dispersed with the prevailing currents. Subsea cleaning may require the use of acid wash chemicals to assist in calcareous marine growth removal. Chemicals selected for use during this activity will follow Santos' Operations Chemical Selection Evaluation and Approval Procedure (EA-91-II-10001). ***Firefighting foam*** During routine testing that could occur on vessels during the activity, aqueous film-forming foam (AFFF) could be discharged from the foam tanks over each area covered by an AFFF firefighting system. It is unavoidable that some of this foam will be discharged to sea unless it is discharged within a closed bunding system. These volumes are very small, residual amounts and are not measurable.
Extent	Localised: Chemicals, residual hydrocarbons and hydraulic fluids may be discharged to the marine environment from the surface or close to the seabed. Discharges will be relatively minor in volume and dissipate quickly in the open ocean marine environment. Temporary localised decline in water quality in the immediate vicinity of the discharge.
Duration	During the life of the activity and during IMMR and CoP activities intermittent discharges will occur and will last from minutes to several hours over the course of the activity.

6.8.2 Nature and scale of environmental impacts

Potential receptors: Water quality, fish (pelagic) and sharks, marine mammals, marine turtles, seabirds, and cultural receptors (totemic species).

The potential environmental impacts from planned chemical and hydrocarbon discharges include:

- temporary localised decline in water quality in the immediate vicinity of the discharge
- toxicity to marine fauna.

6.8.2.1 Physical environment

Acid wash

Inorganic or organic acids used for marine growth removal are expected to rapidly disperse in the offshore marine environment. Due to the small volumes discharged during marine growth removal, impacts to benthic fauna and water quality will be highly localised.

Residual hydrocarbons

Maximum residual hydrocarbon volumes that could be released during IMMR activities are estimated to be at a concentration of 30 ppm as part of the treated water discharge following flushing of the pipeline.

The small volumes and low concentrations of residual hydrocarbon released are expected to rapidly disperse and are unlikely to impact benthic fauna and water quality in the vicinity of the release is expected to quickly return to background.

Paint and chemicals

Removing paint or external coating from DC pipelines releases inert materials into the marine environment, which will either fall to the seabed or disperse with the prevailing currents. These activities are carried out infrequently and will not significantly affect the marine environment. It is unlikely that the dispersed fines will be found in sufficient concentrations to cause toxic effects to marine fauna (e.g. from ingestion) due to the rapid dispersion and open ocean environment.

Treated seawater, MEG, methanol, scale inhibitor and glycol

Treated seawater will contain a biocide, Although biocides typically contain a substance (quaternary ammonium chloride) which is known to be very toxic to aquatic organisms, the concentration is typically very low (less than 30%) within the biocide itself as a whole.

MEG and methanol both have low toxicity, are readily biodegradable, are rated as PLONOR and E (non-CHARM) in the OCNS rankings.

Scale inhibitor is not expected to biodegrade when released to the marine environment. however, scale inhibitor is not known to bioaccumulate. Scale inhibitor and glycol both have low aquatic toxicity and the small volumes released will dilute rapidly when released to the marine environment.

Therefore, it is likely that any impacts to benthic fauna and water quality will be highly localised, if occurring at all.

The discharges of residual hydrocarbons or chemicals in treated water are generally low and are most likely due to entrapment in pockets of subsea system gas or condensate that may be released after flushing of that system Similarly, leak testing would make use of a dye to detect leaks in a subsea system.

Toxicity

On discharge to the marine environment, the low volumes of chemicals and residual hydrocarbons are expected to rapidly disperse in the offshore marine environment. Hence, any potential impacts would be confined to a localised area immediately surrounding the discharge.

There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the release. Toxicity impacts to marine fauna from the release of chemicals are unlikely to eventuate because:

- strong ocean currents result in the discharge being further diluted upon release to the marine environment, so the duration of exposure of chemicals to fauna will be minimal
- the chemicals will have been risk assessed for their suitability for discharge using Operations Chemical Selection Evaluation and Approval Procedure (EA-91-II-10001)
- the sensitivity of the receiving environment is considered low
- potential discharges will be intermittent and temporary within the operational area.

6.8.2.2 Impacts to threatened or migratory fauna

As discussed in the sections above, the discharge extent for all planned chemical and residual hydrocarbon discharges is localised, and rapid dilution is predicted to occur within the offshore waters. Marine fauna within the operational area are likely to be transient. The operational area overlaps with the whale shark foraging BIA, humpback whale migration BIA, turtle and bird BIAs, therefore these species are more likely to be encountered in the operational area. However, if contact does occur with any marine fauna, it will be for a short duration due to the rapid dispersion

of the plume and the transient fauna movement, such that any exposure is likely not of sufficient duration to cause a toxic effect. Impacts to critical habitat identified for turtles that overlaps the operational area will not be significantly modified or affected by these planned chemical and residual hydrocarbon discharges due to the rapid dilution and dissipation in the open ocean waters.

Discharges may cause changes to behaviour in marine fauna (avoidance or attraction). However, such discharges would be isolated occurrences and not in any one location, so no prolonged influence on faunal behaviour is expected. Given the nature of the discharges (localised, rapid dilution, intermittent), any behavioural impacts are expected to be short term and minimal.

Given the nature of discharged chemicals and residual hydrocarbons, the small volumes expect to be released to the marine environment and the nature of the marine environment within the vicinity of the operational area, the planned chemical and hydrocarbon discharges are not predicted to have ecologically significant effects.

6.8.3 Cumulative impacts

There is a potential for support vessels to be in the operational area during IMMR discharges. Discharges from vessels are expected to be small in volume and intermittent in nature. Discharges from IMMR activities are also expected to be of low volume and intermittent in nature. Give the localised intermittent nature of IMMR and vessel discharges, impacts are expected to be negligible.

On this basis cumulative impacts as a result of planned vessel and IMMR discharges are not expected.

6.8.4 Environmental performance objectives and control measures

The EPO relating to this event is:

- Minimise impacts to air and water quality from planned discharges and emissions from activities [EPO-DC-03].

The control measures considered for this event are shown in Table 6-17, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 6-17: Control measures evaluation for planned chemical and residual hydrocarbon discharges

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-26	Chemical selection procedure.	Administrative	Aids in the process of chemical management that reduces the impact of liquid discharges to sea. Only environmentally acceptable products are used.	Cost associated with implementation of procedure. Range of chemicals reduced with potentially higher costs for alternative products.	**Adopted** – Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.
DC-CM-27	General chemical management procedures.	Administrative	Reduces potential for inappropriate discharge of water at sea, through appropriate handling, to maintain planned discharges to sea meet the criteria for not being harmful to the marine environment.	Personnel time associated with vessel inspection and implementation.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
DC-CM-28	Scupper plugs will be available for deployment in the event of a spill to prevent deck drainage.	Isolation	Reduces the risk of spills and leaks (discharges) to sea on vessels through use of scupper plugs or equivalent deck drainage control	Additional personnel costs of ensuring procedures in place and followed.	**Adopted** – Benefits of ensuring procedures are followed outweigh costs.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			measures available where chemicals and hydrocarbons are stored and frequently handled.		
DC-CM-29	Pipeline flushing prior to replacement and repair activities on the pipeline.	Engineering	Production fluids (hydrocarbons) will be flushed through with treated water to the DCGP prior to maintenance activities. Reduces the toxicity of chemicals and residual hydrocarbons in subsea infrastructure before any release to sea during activities.	Additional costs and time taken to flush pipeline.	**Adopted** – Environmental benefits of flushing outweigh the associated costs.
DC-CM-30	Vessel spill response plan (SOPEP/SMPEP).	Administrative	Clean up of hydrocarbon spills to deck in accordance with vessel SOPEP/SMPEP reduces potential impacts of inappropriate discharge of water to sea.	Personnel time associated with maintaining SOPEP/SMPEP stocks and appropriate waste disposal.	**Adopted** – benefits of ensuring procedures are followed and measures implemented and that the vessel is compliant outweighs the costs.
Additional Control Measures					
N/A	Scupper plugs on support vessels are continuously in place to prevent deck drainage.	Isolation	Would eliminate potential impacts of contaminants being discharged to sea in rainwater.	Increased health and 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 benefit given small volumes of contaminants.
N/A	Mandatory closed drain system on support vessels to prevent deck drainage discharged overboard.	Isolation	Would prevent the release of deck spills to sea and therefore reduce environmental impact.	Increased cost due to treatment system required, modifications to vessels, storage space required for containment of drained liquids, increase in transfers to vessels resulting in increased potential impacts and risks. Increased transfers results in increased fuel usage, increased safety risks to personnel during transfer (e.g. crushing between skips), and	**Rejected** – Cost outweighs the benefit given the low impact expected from planned discharges and high potential impacts from the increased transfers required.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
				increase in crane movements.	
N/A	Containment domes to collect any residual hydrocarbon that may be in the line.	Engineering	Reduce or eliminate the release of residual hydrocarbons by opening the existing system or by replacing infrastructure during IMMR work.	Before opening the existing system or replacing infrastructure during IMMR works Santos would flush the line to <30ppm hydrocarbon content with inhibited seawater (often 3x pipeline inventory). After flushing, very minimal volumes of residual hydrocarbons remain. The cost of containment domes and installation is not worth the environmental benefit gained.	**Rejected** – The volumes of residual hydrocarbons post flushing are minimal, therefore containment domes are not required and the cost would outweigh the environmental benefit.
N/A	Do not test AFFF containing fire-fighting equipment vessels.	Elimination	Would eliminate the discharge of the small quantities of AFFF.	Increased safety risk due to potentially untested AFFF system. Inability to fight fire effectively.	**Rejected** – Safety considerations outweigh the environmental benefit given.
DC-CM-49	Calibrated dosing system in place to ensure accuracy of chemical dosing	Engineering	Santos temporary equipment assessment procedure (SO-91-IG-10050) ensures calibration and independent verification of temporary equipment used for chemical dosing of the treated seawater therefore managing potential impact to marine environment to acceptable levels	Implementation of a procedure; cost of independent verification	Adopted – Benefits of ensuring correct chemical dosing maintains pipeline integrity and reduces the potential environmental impact

6.8.5 Environmental impact assessment

Receptor	Consequence Level
Planned chemical and residual hydrocarbon discharges	
Threatened, migratory or local fauna	Marine fauna may transit through the area. There is also a migration BIA for Humpback whales and internesting buffer BIAs for green, hawskbill, land flatback turtles that overlaps the operational area (Section 3.2.7.1). Water quality perturbations may result in an alteration to marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds. Given the infrequency of discharges (potentially annually), and the highly dispersive waters of the NWS, impacts will be limited to short-term water quality impacts and possible temporary behavioural effects observed in fish, sharks and seabirds. The consequence level for Threatened, migratory or local fauna is I – Negligible.

Receptor	Consequence Level
Physical environment or habitat	Impacts to water quality that will be experienced in the discharge mixing zone which ranges from 0 m water depth at the shoreline to approximately 30 m at the commonwealth boundary will be localised and will occur only as long as the discharges occur (i.e. no sustained impacts); therefore, recovery will be measured in hours to days. Furthermore it is noted that discharges in shallow water are either avoided (i.e. sewage/putrescible wastes are not allowed within 3 nm of land) or are reduced in shallow waters simply through the shallow waters limiting the vessel accessibility in shallow areas. Any effects on water quality are expected to be within the surface waters only and have no effect on seabed receptors even in shallow waters given the operational area is within an open coastal environment as opposed to a confined area. Given the infrequency of discharges and the highly dispersive waters of the operational area with strong drift current and local scale currents (average and maximum surface current speeds of 0.30 m/s and 2.51 m/s respectively, RPS 2024)), impacts will be limited to short-term water quality impacts and possible temporary behavioural effects observed in fish, sharks and seabirds. No physical environments or habitats are identified in the area over which Planned chemical and residual hydrocarbon discharges are expected to disperse other than open water. The consequence level for physical environment is I – Negligible.
Socio-economic receptors	Planned chemical and residual hydrocarbon discharges are not expected to impact on socio-economic receptors. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. WAFIC stated that it had concerns about the impact of operational discharges associated with IMMR activities on commercial species and the broader marine environment, with specific reference to treated seawater containing scavenger and biocide discharged in the marine environment. Santos responded to WAFIC concerns related to this EP by providing information on control measures that would be implemented and outlining that a cumulative impact assessment would be undertaken. Santos responded to all the concerns raised by WAFIC and no further concerns were raised. The consequence level for these receptors is considered to be I – Negligible.
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area over which planned discharges are expected.
Protected areas	Not applicable – No protected areas are identified in the area where planned discharges could affect water quality.
Pre-treatment consequence	II - Minor
Overall worst-case consequence	I – Negligible

6.8.6 Demonstration of ALARP

The use of chemicals to conduct testing on seabed equipment is a standard technique that is considered critical in determining the presence of leaks and equipment integrity. Alternatives to the use of chemicals include freshwater. The use of freshwater in the subsea system can result in hydrate formation and introduce integrity risks; therefore, it is not considered feasible. The use of treated seawater is also an industry standard and uses chemicals that have been appropriately risk assessed under the Operations Chemical Selection Evaluation and Approval Procedure (EA 91 II 10001).

Marine growth removal is required on the pipeline so they can be safely removed from the operational area as required by legislation and regulations. Acid wash would only be used for marine growth removal if removal by mechanical means could not be achieved.

Similarly, the release of small volumes of residual hydrocarbons during IMMR cannot be avoided.

The use of AFFF is required for emergency response purposes and routine testing the foam fire-fighting system is critical for maintaining emergency response capabilities on vessels. The product has been assessed through the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001), ensuring potential impacts are acceptable.

The alternative to discharging these small amounts of chemicals and residual hydrocarbons to the marine environment is to store and transport the wastes to land, where they would be disposed of in line with industry best

practice. However, 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 additional wastes. This method would also result in an increased risk of vessel-to-platform or vessel-to-vessel collision, which could lead to a marine diesel spill. Therefore, this option would be of no net environmental benefit and would increase the risk associated with the activity, so it has not been adopted. Some discharges (particularly those subsea) are also not feasible to contain completely.

With implementation of the controls listed above, the environmental impacts and risks associated with chemical and residual hydrocarbon discharges to marine environment is reduced to ALARP

The discharges of residual hydrocarbons or chemicals in treated water following flushing of the DC supply pipeline to the DCGP for intervention activities is expected to be low; e.g. less than 10 L of condensate may be released due to entrapment in pockets of a subsea system after flushing and less than 0.5 L chemicals in treated seawater (e.g. biocide) discharged during temporary opening up of the pipeline. All operations chemicals potentially discharged to sea during the activity will conform to the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) with all chemicals identified and assessed by the Santos Environment Department prior to commencement of the activity.

The continued monitoring and replacement of cathodic protection on the pipeline will reduce the need for future intervention activities by providing added protection of the pipeline.

With implementation of the controls listed above, reduces the environmental impacts and risks associated with liquid waste discharges to the marine environment to ALARP.

6.8.7 Acceptability evaluation

Is the consequence ranked as I or II?	Yes – Maximum consequence from planned chemical and residual hydrocarbon discharges is I (Negligible).
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, 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 3-11. Yes – management consistent with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which in Australian waters is enacted by the Marine Orders.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – WAFIC stated that it had concerns about the impact of operational discharges associated with IMMR activities on commercial species and the broader marine environment, with specific reference to treated seawater containing scavenger and biocide discharged in the marine environment. Santos responded to WAFICs concerns providing information on control measures and assessment of cumulative impacts. WAFIC responded to Santos outlining that it had no further concerns.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The use of hydraulic fluids, acid wash, treated seawater and other chemicals is unavoidable as they are required to safely complete the activities and preserve seabed equipment. The release of residual hydrocarbons during IMMR is also unavoidable during the activity. However, water quality and benthic impacts will be highly localized to the immediate vicinity of the discharge. The operational area is not located nearby to any sensitive habitat.

The application of the chemical selection procedure is an important control for reducing the toxicity of any chemicals that may be discharged during the activities. In accordance with the procedure, CHARM-rated Gold/Silver and non-CHARM grouped E/D chemicals managed under the OCNS, or PLONOR substances listed by OSPAR, or chemicals risk assessed by Santos and deemed environmentally acceptable, will be selected.

With control measures in place to minimise the environmental impact of chemical and hydrocarbon discharges, the consequence was assessed as Negligible (I) and ALARP. The managed discharges will not reduce the habitat values of the area potentially affected as described in relevant Recovery Plans or Approved Conservation Advice or be inconsistent with the strategies of these documents. Concerns raised by WAFIC during the consultation process regarding the impacts of operational discharges associated with IMMR activities were responded to and no further concerns were raised.Therefore, the minor impacts expected from the proposed discharges are considered to be environmentally acceptable.

6.9 Spill response operations

The spill response strategies that may be adopted in the event of a hydrocarbon spill have been identified in the OPEP. Potential impacts arising from the implementation of the following spill response operations and actions have been assessed as planned events in this section. The OPEP covers activities associated with the Reindeer WHP and DC supply pipeline in Commonwealth waters and the DC pipelines in State waters and onshore. It is submitted to both NOPSEMA and DEMIRS for approval.

6.9.1 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 through the net environmental benefit analysis (NEBA) process, outlined in this EP and OPEP. Spill response will be under the direction of the relevant Control Agency, as defined within the OPEP (Section 4), which may be Santos or 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 selected as appropriate for the worst-case oil spill scenarios identified for the event are detailed in Table 3-5 of the OPEP and comprise: • Source control • Monitoring and evaluation • Mechanical dispersion • Shoreline protection and deflection • Shoreline clean-up • Oiled wildlife response • Scientific monitoring • Waste management. While response strategies are intended to reduce the environmental consequences of a hydrocarbon spill, poorly planned and coordinated response activities can result in a lack of, or inadequate information being available, which can lead to poor decisions being made, thereby exacerbating or causing further environmental harm. An inadequate level of training and guidance during the implementation of spill response strategies can also result in environmental harm over and above that already caused by the spill. The greatest potential for impacts additional to those described for routine operations is from shoreline clean-up and oiled wildlife response operations where coastal and shoreline habitat damage and fauna disturbance may occur.
Extent	Spill response will extend to the reaches of the spill event.
Duration	As required only in response to a spill event.

6.9.2 Nature and scale of environmental impacts

Nature and scale of environmental impacts	
Light Emissions	
Spill response activities will involve the use of vessels that are required at a minimum to display navigational lighting. Vessels may operate in close proximity to shoreline areas during spill response activities. Spill response activities will also involve onshore operations, including the use of vehicles and temporary camps, both of which may require lighting.	
Potential receptors:	Fauna (including threatened, migratory or local fauna) Protected areas Socio-economic receptors
Lighting may cause behavioural changes to fish, mammals, birds and marine turtles that can have a heightened consequence during key lifecycle activities, such as turtle nesting and hatching. Turtles and birds, which includes threatened and migratory fauna, have been identified as key fauna susceptible to lighting impacts; Section 6.3 provides further detail on the nature of impacts to fish, birds and marine turtles. Spill response activities that require lighting may take place in protected areas important to turtles and birds, such as shoreline locations of Barrow Island, which are seasonally important for turtles and include BIAs and critical habitats. This could result in indirect impacts on the values of the protected areas. During nesting and hatching season (primarily over summer months), lighting may cause behavioural impacts to turtles, including aborted nesting attempts and misorientation of newly hatched turtles, which may increase hatchling mortality rates. Spill response activities may also occur on shorelines used by nesting and feeding birds, including seabirds and shorebirds. Lighting can cause disorientation in flying birds, disrupt nesting and breeding behaviours and impact on the ability of birds to forage. Disturbance to feeding migratory shorebirds may reduce their ability to replenish energy reserves and alter the timing and success of migratory flights.	

Nature and scale of environmental impacts	
Lighting impacts to fauna are not considered to have the potential to impact supported industries such as tourism.	
Noise emissions	
Spill response activities will involve the use of aircraft and vessels that will generate noise both offshore and in proximity to sensitive receptors in coastal areas. Spill response activities will also involve the use of equipment on coastal areas during shoreline clean-up (e.g. pumps and vehicles), to access shoreline areas (e.g. vehicles) and to support temporary camps (e.g. diesel generators).	
Potential receptors:	Fauna (including threatened, migratory or local fauna) Protected areas Socio-economic receptors
Underwater noise from the use of vessels may impact marine fauna, such as fish and sharks, marine reptiles and marine mammals in the worst instance causing physical injury to hearing organs, but more likely causing short-term behavioural changes which may impact key lifecycle processes (e.g. spawning, breeding, calving). Underwater noise can also mask communication or echolocation used by cetaceans. Section 6.1 provides further detail on these impacts from vessels. Cetaceans have been identified as the key concern for vessel noise within the EMBA. Spill response activities using vessels have the fauna in protected areas, including the Montebello Marine Park. Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna including protected and migratory species of shorebirds and turtles. Shoreline activities involving the use of noise generating equipment may take place in important nesting areas for turtles and/or roosting/feeding areas for shorebirds. As a consequence of impacts to fauna, (including shorebirds, marine mammals, fish and sharks), noise has the potential to impact supported industries such as tourism and commercial fishing. Noise from helicopters may impact cetaceans and other noise sensitive organisms. The Santos Marine Fauna Procedure requires safe distances for helicopters or drones when traveling over marine areas in accordance with State and Federal legislative requirements including licensing.	
Atmospheric Emissions	
The use of fuels to power vessel engines, generators and mobile equipment used during spill response activities will result in emissions of GHGs, such as carbon dioxide, methane and nitrous oxide, along with non-GHGs, such as sulphur oxides and nitrogen oxides. Emissions will result in localised decreases in air quality.	
Potential receptors:	Fauna (including threatened, migratory or local fauna) Physical environment or habitat Protected areas Socio-economic receptors
Atmospheric emissions from spill response equipment will be localised and while there is potential for fauna and flora impacts, the use of 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 and/or areas where tourism is important; however, the scale of the impact relative to potential oil spill impacts is not considered great.	
Operational Discharges and Waste	
Operational discharges include those routine discharges from vessels used during spill response and may include (subject to relevant legislation): • Deck drainage • Putrescible waste and sewage • Cooling water from operation of engines • Bilge water • Ballast water • Brine discharge. In addition, there are specific spill response discharges and waste creation that may occur, including: • Cleaning of oily equipment, vessels and vehicles • Flushing water for the cleaning of shoreline habitats • Sewage, putrescible waste and municipal waste at camp areas • Creation, storage and transport of oily waste and contaminated organics.	

Nature and scale of environmental impacts	
Potential receptors:	Fauna (including threatened, migratory or local fauna) Physical environment or habitat Protected areas Socio-economic receptors

Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, temperature and salinity increases as detailed in Section 6.7. These may impact a different set of receptors than previously described in that section given vessel use may occur in shallower coastal waters during spill response activities. Discharge could potentially occur adjacent to such marine habitats as corals, seagrass, macroalgae, and in protected areas (i.e. receptors anywhere within the EMBA), all of which support a more diverse faunal community. However, discharges will be very localised and temporary.

Cleaning of oil-contaminated equipment, vehicles and vessels, has the potential to spread oil from contaminated areas to those area not impacted by a spill, potentially spreading the impact area and moving oil into a more sensitive environment.

Flushing of oil from shoreline habitats is a clean-up technique designed to remove oil from the receptor that has been oiled and remobilise the oil back into the marine environment, which can result in further dispersion of the oil. The process of flushing has the potential to physically damage shoreline receptors, such as mangroves and rocky shoreline communities, increase levels of erosion, and create an additional, and potentially higher, level of impact than if the habitat was left to bioremediate.

Sewage, putrescible waste and municipal waste will be generated from onshore activities at temporary camps, which may include toilet and washing facilities. These wastes have the potential to attract fauna; impact habitats, flora and fauna; and reduce the aesthetic value the environment areas, all of which may be within protected areas. The creation, storage and transport of oily waste and contaminated organics has the potential to spread impacts of oil to areas, habitats and fauna not previously contaminated.

Physical Presence and Disturbance

The movement and operation of vessels, vehicles, personnel and equipment and the set-up of temporary camp areas during spill response activities has the potential to disturb the physical environment and marine and coastal habitats and fauna, which may include those habitats and fauna within protected areas. Disturbance may also impact cultural values of an area. The movement of vessels could potentially introduce to nearshore areas invasive marine species attached as biofouling, while vehicle and equipment movement could spread non-indigenous flora and fauna.

Oiled wildlife response activities may involve deliberate disturbance (hazing), capture, handling, cleaning, rehabilitation and release of wildlife, which could lead to additional impacts to wildlife.

Potential receptors:	Fauna (including threatened, migratory or local fauna) Physical environment or habitat Protected areas Socio-economic receptors

The use of vessels may disturb benthic habitats in coastal waters including corals, seagrass, macroalgae and mangroves. Impacts to habitats from vessels include damage through the deployment of anchors, chains and nearshore oil containment booms, and from grounding. Vessel use in shallow coastal waters also increases the chance of contact or physical disturbance with marine megafauna, such as turtles and dugongs. Booms create a physical barrier on the surface waters that has the potential to injure or entangle passing marine fauna that are either surface breathing or surface feeding.

Vehicles, equipment and personnel used during shoreline response activities have the potential to damage such coastal habitats as dune vegetation, mangroves and habitats important to threatened and migratory fauna and to damage nests of turtles and birds and bird roosting or feeding areas. Shoreline clean-up may involve the physical removal of substrates that could cause impact to habitats and coastal hydrodynamics and alter erosion or accretion rates.

The presence of camp areas, although relatively short-term may disrupt normal behaviour of such coastal species as shorebirds and turtles, and could potentially interfere with nesting and feeding behaviours.

Oiled wildlife response may include the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling such as birds and marine turtles. While oiled wildlife response is aimed at having a net benefit, poor response can potentially create additional stress and exacerbate impacts from oiling, interfering with lifecycle processes, hampering recovery and in the worst instance increasing levels of mortality. Impacts and risks from invasive marine species are described in Section 7.1 and are not described further in this section.

Impacts from invasive terrestrial species (e.g. weeds) are similar to those of invasive marine species in that the invasive species can outcompete local species and interfere with ecosystem processes. Non-native species may be transported attached to equipment, vehicles and clothing. Such an introduction would be especially detrimental to wilderness areas or protected terrestrial reserves, which may have a relatively undisturbed flora and fauna community.

The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow on impacts to socio-economic values and industry (e.g. tourism, fisheries).

Disruption to Other Users of Marine and Coastal Areas and Townships

Spill response activities may involve the use of vessels, equipment and vehicles, and the establishment of temporary camps, in areas used by the general public or industry. The mobilisation of spill response personnel into an affected area may also place increased demands on local accommodation and other businesses.

Nature and scale of environmental impacts	
Potential receptors:	Socio-economic receptors
The use of vessels in the nearshore and offshore environment and the undertaking of spill response activities at shoreline locations may exclude general public and industry use of the affected environment. As well as impacting leisure activities of the general public, this may impact on revenue with respect to such industries as tourism and commercial fishing. The mobilisation of personnel to small 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.	

6.9.3 Environmental performance objectives and control measures

Environmental Performance Outcomes (EPOs), control measures, Environmental Performance Standards (EPSs) and measurement criteria for spill preparedness and response activities are outlined within the relevant strategy sections of the OPEP. Control measures relevant to reducing the potential impacts from spill response operations are shown in Table 6-18

Table 6-18: Control measures for reducing potential impacts from spill response operations

Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Competent Incident Management Team (IMT) and oil spill responder personnel.	Ensures that spill response strategy selection and operational activities consider the potential for additional environmental impacts.	Personnel and operational costs associated with maintaining competent IMT team and responder personnel.	**Adopted** – Considered a standard spill response control.
Use of competent vessel crew and personnel.	Reduces potential for environmental impacts from vessel usage.	Personnel and operational costs associated with maintaining contracts with competent vessel crew and personnel.	**Adopted** – Considered a standard spill response control.
Spill response activities selected on basis of a NEBA	Provides a systematic and repeatable process for evaluating strategies with net least environmental impact.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control.
Noise emissions			
Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	Reduces potential for behavioural disturbance to cetaceans.	No cost/issue associated with this control measure.	**Adopted** –Ensures compliance with Part 8 of the EPBC Regulations 2000, which is considered a standard spill response control (regulatory requirement).
Light Emissions			
Select temporary base camps in consultation with DoT and DBCA.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency.
Atmospheric Emissions			
If required under MARPOL, vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate.	Reduces level of air quality impacts.	Personnel and operational costs associated with maintaining Air Pollution Certificate.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Disruption to Other Marine Users			
Stakeholder consultation.	Promotes awareness and reduces potential impacts from response to socio-economic activities.	Minimal cost in relation to overall effort/costs in managing incident.	**Adopted** – Considered a standard control for incident management
Utility resource assessment and support to be conducted if activity is of significant size in comparison	Reduces potential impact due to higher utility demands causing disruptions to local community.	No cost / issue associated with this control measure.	**Adopted** – Considered a standard control.

Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
to the size of the coastal community			
Accommodation assessment	Reduces strain on accommodation.	No cost / issue associated with this control measure.	**Adopted** – Considered a standard control.
Transport Management Plan	Reduces potential for traffic disruptions.	No cost / issue associated with this control measure.	**Adopted** – Considered a standard control for large-scale deployment in highly populated areas.
Operational Discharges and waste			
Vessels meet applicable MARPOL and Marine Park sewage disposal requirements.	Reduces potential for water quality impacts.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Vessel meet applicable MARPOL requirements for oily water (bilge) discharges.	Reduces potential for water quality impacts.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Ballast Water Management Plan	Improve quality of water discharged to marine environment to ALARP.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Approved oily water decanting.	Reduces impact from discharge of oily water from storage. Frees up space in liquid waste containers to allow further waste collection.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Compliance with controlled waste, unauthorised discharge and landfill regulations.	Ensures correct handling and disposal of oily wastes.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard spill response control (regulatory requirement).
Physical presence and disturbance			
Spill response activities selected on basis of a net environmental benefit analysis.	Provides a systematic and repeatable process for evaluating strategies with net least environmental impact.	No cost/issue associated with this control measure	**Adopted** – Considered a standard spill response control.
Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	Reduces potential for behavioural disturbance to cetaceans.	No cost/issue associated with this control measure.	**Adopted** – Ensures compliance with Part 8 of the EPBC Regulations 2000, which is considered a standard spill response control (regulatory requirement).
Use of shallow draft vessels for shoreline and nearshore operations.	Reduce seabed and shoreline disturbance.	Operational costs associated with operating shallow draft vessels for shoreline and nearshore operations.	**Adopted** – Considered a standard control.
OSR Team Leader assesses and selects vehicles appropriate to shoreline conditions.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Conduct shoreline, nearshore habitat, bathymetry assessment.	Reduce shoreline habitat disturbance.	Operational costs associated with conducting shoreline nearshore habitat assessment.	**Adopted** – Considered a standard control.
Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting and roosting areas and turtle nesting habitat.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.

Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Operational restriction of vehicle and personnel movement to limit erosion and compaction.	Reduce coastal habitat erosion and compaction.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Prioritise use of existing roads and tracks.	Reduce coastal habitat and fauna disturbance.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control.
Soil profile assessment prior to earthworks.	Reduce habitat disruption and erosion.	Operational costs associated with soil profile assessment.	**Adopted** – Considered a standard control.
Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance.	Reduce disturbance to culturally significant sites.	No cost/issue associated with this control measure.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency.
Pre-cleaning and inspection of equipment (quarantine).	Reduces potential for invasive species to offshore islands	Cost/effort in inspecting equipment.	**Adopted** – Considered a standard control.
Adhere to WA Oiled Wildlife Response Plan and Pilbara Regional Oiled Wildlife Response Plan	Oiled wildlife hazing, capture, handling and rehabilitation meet minimum standards as outlined within the WA Oiled Wildlife Response Plan.	Operational costs associated with response plan.	**Adopted** – Considered a standard control to be adopted by the relevant Control Agency.

6.9.4 Environmental impact assessment

Receptor	Consequence Level
Spill Response Operations – Light Emissions	
Threatened, migratory, or local fauna Physical environment or habitat Threatened ecological communities Protected areas Socio-economic receptors	The receptors considered most sensitive to lighting from vessel and shoreline operations are seabirds, shorebirds and marine turtles, particularly over summer months with respect to marine turtles where emerging hatchlings are sensitive to light spill onto beaches. Following 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 A (*Negligible*). Temporary camps will be positioned at the direction of DoT or DBCA and control measures on lighting colour and direction will be followed; therefore, the consequence of shoreline lighting is considered *Negligible*. These species are likely to be values of the protected area they occur in (e.g. Montebello Islands), and the impact to the protected area from light is also considered *Negligible*. As a consequence of impacts to fauna, lighting has the potential to impact supported industries, such as tourism; however, as impacts to fauna are considered negligible, any indirect impacts on tourism will also be *Negligible*.
Pre-treatment consequence level	I – Negligible
Overall worst-case consequence level	I – Negligible
Spill Response Operations – Noise emissions	
Threatened, migratory, or local fauna Physical environment or habitat Threatened ecological communities Protected areas Socio-economic receptors	The receptor considered most sensitive to vessel noise disturbance is the humpback whale during migration season, when these whales come close to the Montebello Islands and Barrow Island during their peak migration (July–October), as well as populations of marine turtles, whale sharks and pygmy blue whales. However, following the adoption of control measures to limit close interaction with protected fauna (i.e. Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003)), a temporary behavioural disturbance is expected only with a consequence of *Negligible.* With respect to noise from onshore operations (mobile equipment and vehicles), nesting, roosting or feeding birds are considered to be the most sensitive to noise, in particular shorebirds that may be aggregating at Montebello Islands and Barrow Island. The equipment used is not considered to have excessive sound levels and, following direction by DoT and DBCA on the location of temporary camp areas, the consequence to birds from noise is expected to be *Negligible*. Shorebirds may be official values of the protected area they occur in, and the impact to the protected area from noise is also considered *Negligible*.
Pre-treatment consequence level	I – Negligible

Receptor	Consequence Level
Overall worst-case consequence level	I – Negligible
Spill Response Operations – Atmospheric Emissions	
Threatened, migratory, or local fauna	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 emissions will be localised and low level, impacts to protected area values, physical environment and socio-economic receptors are predicted to be *Negligible*.
Physical environment or habitat	
Threatened ecological communities	
Protected areas	
Socio-economic receptors	
Pre-treatment consequence level	I – Negligible
Overall worst-case consequence level	I – Negligible
Spill Response Operations – Operational Discharges and Waste	
Threatened, migratory, or local fauna	Operational discharges from vessels may create a localised and temporary reduction in marine water quality, which has the potential to impact shallow coastal habitats in particular; however, following the adoption of regulatory requirements for vessel discharges, which prevent discharges close to shorelines, discharges will have a *Negligible* impact to habitats, fauna or protected area values. Furthermore, washing of vessels and equipment will take place only in defined offshore hot zones preventing impacts to shallow coastal habitats. As a consequence of impacts to fauna, operational discharges from vessels has the potential to impact supported industries, such as tourism and commercial fishing; however, as impacts to fauna are considered *Negligible*, any indirect impacts on socio-economic receptors will also be *Negligible*. Onshore, the use of flushing water has the potential to damage sensitive shoreline and intertidal habitats, e.g. mangroves; however, low-pressure flushing only will be used, preventing further damage to habitats or erosion of sediments. For sensitive habitats, the deployment of booms will be considered to retain flushed hydrocarbons, if this presents a net benefit. Following these control measures, the use of flushing to clean shorelines and intertidal habitats is seen to have a *Negligible* additional impact to habitats, fauna or protected area values. The cleaning of contaminated vehicles and equipment onshore has the potential to spread oily waste and damage habitats if not contained. Decontamination units will be in used during the spill response, thus containing waste and preventing any secondary contamination. The consequence of cleaning discharges is therefore ranked as *Negligible* in terms of impacts to habitats, fauna or protected area values. Sewage, putrescible waste and municipal waste generated onshore will be stored and disposed of at approved locations. The storage, transport and disposal of hydrocarbon-contaminated waste arising from spill response operation actions, such as containment and recovery and shoreline clean up, will be managed by Santos' appointed waste management contractor; and dedicated waste containment areas will prevent the spreading or leaching of hydrocarbon contamination. The consequence of sewerage discharges is therefore ranked as *Negligible* in terms of impacts to habitats, fauna or protected area values.
Physical environment or habitat	
Threatened ecological communities	
Protected areas	
Socio-economic receptors	
Pre-treatment consequence level	II-Minor
Overall worst-case consequence level	I – Negligible
Spill Response Operations – Physical Presence and Disturbance	
Threatened, migratory, or local fauna	The use of vessels and nearshore booms has the potential to disturb benthic habitats, including sensitive habitats in coastal waters, such as corals, seagrass, macroalgae and mangroves. A review of shoreline and shallow water habitats and of bathymetry and the establishment of demarcated areas for access and anchoring (along with other control measures in Section 6.6) will reduce the level of impact to *Negligible*. The use and movement of vehicles, equipment and personnel during shoreline response activities has the potential to disturb coastal habitats, such as dune vegetation, samphire and mangroves, and important habitats of threatened and migratory fauna, including nests of turtles and birds and
Physical environment or habitat	
Threatened ecological communities	
Protected areas	

Receptor	Consequence Level
Socio-economic receptors	bird roosting areas. Furthermore, clean-up can involve physical removal of substrates that could impact habitats and fauna and alter coastal hydrodynamics. As with vessel use, an assessment of appropriate vehicles and equipment to reduce habitat damage, along with the establishment of access routes, demarcation zones, and operational restrictions on equipment and vehicle use, will limit sensitive habitat damage and damage to important fauna areas. The establishment of temporary camp areas will be done under direction of DoT and DBCA with suitable advice sought if access is needed to culturally significant areas. Following these and other control measures, the resultant consequence to the physical environment and habitat is assessed as minor, indicating that there may be a detectable reduction in habitat area from response activities (as separate from spill impacts), but recovery will be relatively rapid once spill response activities cease. As with all spill response activities, this disturbance will only occur if there is a net benefit to accessing and cleaning shoreline areas. The main direct disturbance to fauna would be the hazing, capture, handling, transportation, cleaning and release of 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 the WA Oiled Wildlife Response Plan and the Pilbara Region Oiled Wildlife Response Plan. These habitats or environments are likely to be values of the protected area they occur in, and the impact to the protected areas from physical disturbance is therefore also considered II-Minor. The disturbance to marine and coastal natural habitat, as well as the potential for disruption to culturally sensitive areas, which may occur in specially protected areas, may have flow-on impacts to socio-economic values and industry (e.g. tourism, fisheries). This impact is considered II-Minor
Pre-treatment consequence level	II-Minor
Overall worst-case consequence level	II – Minor
Spill Response Operations – Disruption to Other Users of Marine and Coastal Areas and Townships	
Threatened, migratory, or local fauna	The use of vessels in the nearshore and offshore environment and spill response activities at shoreline locations and within townships may exclude general public and industry use. Note that this is distinct from the socio-economic impact of a spill itself, which would have a far greater detrimental impact to industry and recreation. Following the application of control measures, it is considered that the additional impact of spill response activities on affected industries would be II-Minor.
Physical environment or habitat	
Threatened ecological communities	
Protected areas	
Socio-economic receptors	
Pre-treatment consequence level	II-Minor
Overall worst-case consequence level	II – Minor

6.9.5 Demonstration of ALARP

A net environmental benefit analysis is the primary tool used during spill response to evaluate response strategies with the goal of selecting strategies that result in the least net impact to key environmental sensitivities. The NEBA process is conducted once an oil spill occurs will identify and compare net environmental benefits of alternative spill response options. The NEBA will effectively determine whether an environmental benefit will be achieved through implementing a response strategy compared to undertaking no response. NEBA will be undertaken by the relevant Control Agency for the activity. For those activities under the control of Santos, the Environmental Team Leader will be responsible for reviewing the priority receptors and selected response strategies identified within the OPEP and coordinating the NEBA for each operational period. This will ensure that, at the strategy level, the response operations reduce additional environmental impacts to ALARP.

Spill response activities will be conducted in offshore and coastal waters using vessels and aircraft. The greatest potential for additional impacts from implementing spill response is to wildlife in offshore waters from oiled wildlife response activities, and to shoreline habitats and fauna receptors within shallow waters or on shorelines from shoreline clean-up activities.

Given the types of activities considered appropriate to responding to a worst-case spill and the scale of operations, the standard control measures adopted by Santos for spill response to reduce the level of additional impacts are considered to reduce these impacts to ALARP. This includes working with the relevant Control Agency for spill

response, and applying the processes and standards; e.g. for oiled wildlife response as included in the WA Oiled Wildlife Response Plan.

Santos has considered the actions prescribed in the Recovery Plan for Marine Turtles in Australia (CoA, 2017) and approved conservation advice for other relevant threatened fauna relevant to spill responses for the activities to minimise noise and light impacts on marine cetaceans, fish, sharks and marine turtles, especially flatback turtles. The proposed activity will not result in significant impacts on these species, and implementation of identified control measures is in line with the relevant conservation advice and recovery plans. Pollution events (such as hydrocarbon spills) could impact on fauna, and the use of vessels and equipment during the spill response could result in potential impacts as described in this EP. Control measures in place for vessel and helicopter use as provided in Section 6.8 will reduce potential impacts to marine fauna, and these are consistent with current conservation advice. The assessed residual consequence for this impact is minor and cannot be reduced further without grossly disproportionate costs. It is considered therefore that the impact of the activities conducted is ALARP.

Onshore spill responses described in the OPEP include the use of vehicles and oil spill response equipment in the immediate vicinity of the pipeline.

6.9.6 Acceptability evaluation

Is the consequence ranked as I Negligible or II-Minor?	Yes – Maximum consequence is a II- Minor.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – IUCN principles of nearby reserves (Montebello AMP and the MPNMP) are met. Control measures implemented will minimise the potential impacts from spill response activities to protected areas and their values and to species identified in recovery plans and conservation advice as having the potential to be impacted. Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised by stakeholders for this event. During any spill response, a close working relationship with relevant regulatory bodies (e.g. DoT, DBCA, AMSA, Director of National Parks) will occur, thus there will be ongoing consultation with relevant stakeholders on the acceptability of response operations. Wildlife response will be conducted in accordance with the WA Oiled Wildlife Response Plan.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The implementation of 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 consistent with relevant standards and guidelines, including the National Plan for Maritime Environmental Emergencies (AMSA, 2020). No concerns from stakeholders 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 therefore considered to reduce additional impacts and risks to an acceptable level.

7. Environmental assessment for unplanned events

P(SL)(E)R 2012 Requirements
Regulation 14(3)
The environment plan must include: a. details of all environmental impacts and environmental risks of the petroleum activity; and b. an evaluation of those impacts and risks; and c. a description of the environmental risk assessment process used to evaluate those impacts and risks, including the terms used in that process to categorise the levels of seriousness of those impacts and risks.
Regulation 14(4)
For the avoidance of doubt, the evaluation mentioned in subregulation (3)(b) must evaluate all the environmental impacts and environmental risks arising directly or indirectly from: a. all aspects of the petroleum activity; and b. potential emergency conditions, whether resulting from accident or any other cause

Two ENVID workshops (as described in Section 5) for planned and unplanned activities were held on 30 April 2024 and 02 May 2024, covering both the Reindeer and DC pipelines. This workshop identified potential sources of environmental impact associated with the planned activities for this activity. The consequence rankings resulting from the environmental assessments are summarised in Table 7-1. A comprehensive risk and impact assessment for each of the unplanned events, and subsequent control measures proposed by Santos to reduce the risk and impacts to ALARP and acceptable levels are details in the following subsections.

Section 7.6 also describes the credible spill scenarios and relevant information on the hydrocarbon spill modelling conducted for the activity

Table 7-1: Summary of the risk assessment ranking for unplanned activities

EP Section	Hazard/Risk	Pre-treatment consequence	Consequence	Likelihood	Residual risk ranking
7.1	Introduction of invasive marine species	IV-Major	IV - Major	b - Unlikely	Low
7.2	Marine fauna interaction	III-Moderate	III - Moderate	c - Possible	Low
7.3	Release of solid objects (large objects)	III-Moderate	III - Moderate	b - Unlikely	Low
	Release of solid objects (small objects)	II-Minor	II - Minor	c - Possible	Low
7.4	Hazardous liquid releases (marine environment)	I-Negligible	I - Negligible	b - Unlikely	Very Low
7.5	Terrestrial flora and fauna interaction	III-Moderate	III - Moderate	c - Possible	Low
	Terrestrial flora and fauna interaction (accidental fire)	III-Moderate	III - Moderate	b - Unlikely	Low
7.7	Subsurface release of condensate from the DC supply pipeline at the CSB boundary	III-Moderate	III - Moderate	a - Remote	Very Low
	Subsurface release of condensate from the DC supply pipeline at the HDD crossing	III-Moderate	III - Moderate	a - Remote	Very Low
7.8	Surface release of diesel (vessel collision at the CSB)	IV-Major	III - Moderate	a - Remote	Very Low
	Surface release of diesel (vessel collision at HDD crossing)	IV-Major	III - Moderate	a - Remote	Very Low
7.9	Onshore release of condensate from the DC supply pipeline	III-Moderate	III - Moderate	a- Remote	Very Low
7.10	Unplanned release of treated seawater	II-Minor	II-Minor	a-Remote	Very Low
7.11	Unplanned release of nitrogen	I-Negligible	I-Negligible	a-Remote	Very Low

7.1 Introduction of invasive marine species

7.1.1 Description of event

Event	Introduction of invasive marine species may occur due to: • Biofouling on support vessels and external/internal niches (e.g. sea chests, seawater systems) • Biofouling on equipment that is routinely submerged in water (e.g. mooring lines and ROVs) • Discharge of high risk ballast water • Cross-contamination between vessels. Once established, invasive marine species (IMS) have the potential to outcompete indigenous species and affect overall native ecosystem function.
Extent	Localised (seabed within the operational area) to widespread (if successfully translocated to new areas via ocean currents or project equipment transit).
Duration	Temporary to long-term (in the event of successful translocation and establishment).

7.1.2 Nature and scale of environmental impacts

Potential receptors: Physical environment (benthic habitats), threatened/migratory fauna (marine mammals, marine reptiles, sharks, fish, and rays), protected areas, socio-economic receptors (fisheries, tourism, and recreation) and cultural aspects (sea country, potential for totemic species).

Invasive marine species are marine plants, animals and algae that have been introduced into a region that is beyond their natural range but can survive, and possibly thrive (Department of Agriculture, Fisheries and Forestry (DAFF), 2011). The majority of climatically compatible IMS of the NWS are found in southeast Asian countries.

Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism (Wells *et al*., 2009; DAFF, 2011). When IMS achieve pest status, they are commonly referred to as introduced marine pests and can cause a variety of adverse effects in a receiving environment, including:

- Over predation of native flora and fauna
- Outcompeting of native flora and fauna for food
- Human illness through released toxins
- Depletion of viable fishing areas and aquaculture stock
- Reduction of coastal aesthetics
- Damage to marine and industrial equipment and infrastructure.

The above impacts can result in flow-on detrimental effects to fisheries, tourism, and recreation. IMS of concern are those that are not native to the region, are likely to survive and establish in the region, and are able to spread by human-mediated or natural means.

IMS of concern are those that are not native to the region, are likely to survive and establish in the region, and are able to 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.

Following their establishment, eradication of IMS populations is difficult, 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 Commonwealth and State regulatory agencies.

Potential sources for the introduction of marine species into the DC operational area include biofouling on the support vessels, including external niches (e.g. propulsion units, steering gear and thruster tunnels) and internal niches (e.g. sea chests, strainers, seawater pipe work, anchor cable lockers and bilge spaces).

Equipment that is submerged in water for periods of time (e.g. ROVs) may acquire marine pest species, which can be spread if the equipment is not cleaned prior to use in pest-free areas.

Support vessels based in local ports, such as Dampier or Onslow, do not carry the same quarantine risks as international vessels (e.g. offtake tankers) or out-of-State vessels, as they supply the same waters as those the DC supply pipeline resides in.

7.1.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- No introduction of marine pest species [EPO-DC-06].

The control measures considered for this event are shown in Table 7-2, with EPS and measurement criteria for the EPO described in Table 8-2.

Table 7-2: Introduction of IMS – Control measures evaluation

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Costs/Issues	Evaluation
Standard Controls					
DC-CM-31	Implementation of the management controls in the Santos Invasive Marine Species Management Plan (IMSMP)	Administrative	The risk of introducing IMS is reduced due to assessment procedure and management of ballast water.	Personnel costs involved in risk assessing vessels in accordance with the Invasive Marine Species Management Plan. Costs associating with reducing the vessel risk to 'low' (for example, dry docking, hull cleaning or additional costs due to inspections). Could lead to potential delays and therefore costs in vessel contracting process due to unavailability of vessels.	**Adopted** – Minimal personnel costs and potential delays or costs to project are considered outweighed by the benefits of reducing the risk of IMS.
DC-CM-32	Anti-foulant system.	Protective	The risk of introducing IMS is reduced due to anti-foulant systems.	Could lead to potential delays and therefore costs, in vessel contracting process due to availability of vessels with appropriate anti-foulant systems.	**Adopted** – Minimal potential delays or costs to project are considered outweighed by the benefits of reducing the risk of IMS.
Additional Control Measures					
N/A	Heat treatment of ballast water to eliminate IMS.	Protective	Would reduce potential for IMS to establish by eliminating individuals present in ballast water.	High cost compared to existing risk; introduction of water at much higher temperature than surrounding marine environment would likely result in death of native marine species.	**Rejected** – Based on increased risk to marine environment compared to base case risk.
N/A	Restrict vessel operations to using vessels and equipment that have only operated in local, State or Commonwealth waters to reduce potential for IMS.	Administrative	Reduce potential for IMS to be transported into area since vessels would not have originated elsewhere.	Vessels and equipment suitable for the activity may not be available in State/National waters therefore work could not be completed.	**Rejected** – Not feasible.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Costs/Issues	Evaluation
N/A	Mandatory dry docking of vessels prior to entering field to clean vessel and equipment and remove biofouling.	Eliminate	Ensure no IMS are present on vessel or associated equipment.	Significant cost (grossly disproportionate to the risk); would lead to scheduling delays.	**Rejected** – Costs disproportionately high compared to environmental benefit given that other controls in place already reduce the risk.
N/A	Use an alternative ballast system to avoid uptake or discharge of water.	Substitute	Eliminate need for ballast water exchange, therefore decreasing risk of introducing IMS through ballast water.	Vessels suitable for the activity may not have options for alternative ballast system therefore would require modification at significant cost.	**Rejected** – Costs disproportionately high compared to environment benefit.
N/A	Zero discharge of ballast water.	Eliminate	Would reduce the potential for IMS by implementing a no ballast water exchange policy on support vessels.	Ballast water exchange required on the support vessels for stability.	**Rejected** – On the basis that ballast water exchange is a safety-critical activity for marine operations.

7.1.4 Environmental impact assessment

Introduction of Invasive Marine Species	
Key receptors	Socio-economic impacts Threatened, migratory or local fauna Physical environment or habitat
Pre-treatment consequence	IV-Major
Consequence level	IV – Major
Introduction of invasive marine species may cause disruptions to other marine users through impact to marine primary producers, reduced access to fishing grounds and introduction of contaminants or invasive species. Ballast water is responsible for 20 to 30% of all marine pest incursions into Australian waters; however, research indicates that biofouling (the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces) has been responsible for more foreign marine introductions than ballast water (DAFF, 2011). IMS, if successfully established, can outcompete native species for food or space, preying on native species or changing the nature of the environment, and can subsequently impact on fisheries or aquaculture. If an IMS is introduced, the species has been known to colonise areas outside of the areas it is introduced to. In the event that an IMS is introduced into the operational area, given the lack of diversity and extensiveness of similar benthic habitat in the region, there would only be a minor reduction in the physical environment. No threatened ecological communities are present in the area that could be affected. The overall consequence level was assessed as *Major.*	
Likelihood	b –Unlikely
The pathways for invasive marine species introduction are well known; consequently, standard preventive measures are proposed. The ability for invasive marine species to colonise a habitat depends on a number of environmental conditions. It has been found that 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). Invasive marine species are more likely to populate shallower areas with favourable substrates. Although the operational area does have shallower waters close to the coastline, the substrate is relatively bare and not as conducive to the establishment of IMS. With control measures in place to reduce the risk of introduction of invasive marine species, the likelihood of introducing an invasive marine species is considered *Unlikely*.	
Residual Risk	Low.

7.1.5 Demonstration of ALARP

Support vessels are required for the safe and efficient operation of the pipeline. Without vessels providing support for operational activities via subsea inspections and IMMR, the risk of equipment failure leading to a safety or

environmental incident is increased. Therefore, eliminating subsea equipment inspection activities or inspections to eliminate the risk of introducing invasive marine species is not considered practicable.

Ballast water exchange will be managed through Ballast Water Management actions consistent with the Australian Ballast Water Management Requirements (Department of Agriculture and Water Resources), Australian Biofouling Management Requirements (DAFF, 2023) and a vessel biosecurity risk assessment in accordance with the Invasive Marine Species Management Plan (EA-00-RI-10172) will be undertaken to demonstrate that vessels are low risk so that IMS are not introduced.

The frequency of subsea inspections has been scheduled for the safe operational duration to proactively prevent equipment failure based on Santos' experience on the North West Shelf. Smaller vessels are more likely to be sourced locally, reducing the potential for invasive marine species presence. Therefore, the frequency of vessels required in the field is considered ALARP, based on the required safe operation and maintenance requirements of the platform and pipeline.

Ballast water exchange will be managed through a Ballast Water Management Plan, and a vessel biosecurity risk assessment in accordance with the Invasive Marine Species Management Plan (EA-00-RI-10172) will be undertaken to demonstrate that vessels are low risk so that IMS are not introduced.

Santos has adopted a risk-based approach to managing biofouling given it is not practicable or reasonable to inspect and/or clean every vessel before each voyage. Such an approach is consistent with other petroleum operators on the North West Shelf and is beyond that enforced on the majority of commercial and recreation vessels that regularly transit the same bioregion. International vessels are given the highest priority to prevent the introduction of IMS into Australian waters. However, domestic vessels (interstate and locally sourced) are also risk-assessed to reduce the likelihood of spreading marine pest species already established in Australian waters. The biofouling risk assessment approach adopted by Santos will ensure that the Aquatic Resources Management Act 2016[4], Biosecurity Amendment (Biofouling Management Regulations 2021) and other associated regulations prohibiting the introduction of non-endemic fish species will be met. Vessel to vessel contamination is considered unlikely as usually only 1 vessel is required for the activities described in this EP.

No other controls were identified to reduce the risk of introducing invasive marine species. Therefore, with the above control measures in place, the risk of introducing invasive marine species has been reduced to ALARP.

7.1.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – Introduction of invasive marine species residual risk ranking is Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with the *Biosecurity Act 2015* and National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and the *Aquatic Resources Management Act 2016*.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The mobilisation of vessels and equipment to undertake offshore petroleum activities is industry standard practice, and the IMS risks are well understood and subject to regulation. The vessels and equipment that are internationally mobilised will meet Australian biosecurity requirements, and proposed management is consistent with National Biofouling Management Guidance for the petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and Australian Biofouling Management Requirements (DAFF, 2023).

[4] *The* Aquatic Resources Management Act 2016 *will replace the* Fish Resources Management Act 1994 *and the* Pearling Act 1990. *The new act was scheduled for commencement on 1 January 2019; however, commencement has been deferred while an amendment to the act is progressed.*

Application of the proposed control measures and adherence to legislation and regulations reduce the likelihood of introducing IMS into the operational area, and the dispersive offshore location in the operational area reduces the probability of successful establishment in the unlikely event of introduction.

No stakeholder 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.

7.2 Marine fauna interaction

7.2.1 Description of event

Event	There is the potential for vessels or equipment (e.g. ROV) involved in activities for operations, IMMR and CoP to interact with marine fauna, including potential strike or collision potentially resulting in severe injury or mortality. Fauna strike may also occur from drone collision, during take-off and landing.
Extent	Within the operational area, in the immediate vicinity of support vessels, subsea equipment, vehicles or drones while moving.
Duration	When undertaking intermittent vessel, drone and helicopter operations during operations, IMMR and CoP activities.

7.2.2 Nature and scale of environmental impacts

Potential receptors: Threatened or migratory fauna (marine mammals, marine turtles, sharks and rays, fish, and birds)

Movement of support vessels in the operational area introduces the potential for interaction with marine fauna present at the same location during the activity. Marine fauna in surface waters that would be most at risk from vessel collision include marine mammals, marine reptiles and whale sharks. A summary of the marine fauna and BIAs which intersect with the operational area is in Table 3-9.

Vessel strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advices (Table 3-11). Incidents with marine fauna are recorded and reported by Santos as described in Table 8-4.

7.2.2.1 Marine reptiles

Turtle-vessel interactions arising from increased vessel traffic is also recognised as one of a number of key impacts to marine turtles in the Recovery Plan for Marine Turtles in Australia (CoA, 2017). Marine turtles are highly mobile and, given the low speeds of vessels used for the activity, are likely to be able to move from an area where there is vessel activity. Marine turtles make extensive migrations through the region and it is possible that individual turtles of any of the species known from the region may be encountered in the operational area, particularly given the proximity to the designated flatback turtle BIA associated with the Montebello Islands and Barrow Island nesting locations. However, given the distance to nesting beaches and the absence of important foraging habitat for any species in the operational area, large numbers of turtle encounters are not expected.

Marine turtle mortality due to boat strike has been identified as an issue in Queensland waters in the Recovery Plan for Marine Turtles in Australia (CoA, 2017). However, turtles appear to be more vulnerable to boat strike in areas of high urban population where incidents of pleasure crafts are higher. WA turtle populations have not been highlighted as those most affected by boat strike, possibly due to the relatively low human population density of the NWS coastline.

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 increased. 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.

Sea snakes are known to intermittently occur within the operational area. During use of ROVs for inspections in close proximity to subsea infrastructure, sea snakes are at risk of strike by the ROV thrusters. Impacts could range from injury to the individual to mortality.

7.2.2.2 Marine mammals

The Conservation Management Plan for the blue whale (Commonwealth of Australia, 2015b) recognises vessel strike as a threat to their recovery. The northern migration for pygmy blue whales occurs coast between May and August, and the south bound migration in November and December. Pygmy blue whales are at risk from vessel strikes when feeding near the surface or coming to the surface to breathe. The operational area does not overlap the migration BIA, consequently, pygmy blue whales are unlikely to occur in the operational area in significant numbers, with observed and modelled distributions of pygmy blue whales occurring further offshore in deeper water (Double et al., 2014; Thums et al., 2022). Their presence is not expected to be significant as there is no main aggregation area. The operational area does not have any constraints that would prevent pygmy blue whales from moving away from vessels.

Humpback whales are seasonally present in the NWS region during their annual migrations to and from breeding areas in northern Western Australia. The migration BIA for humpback whales overlaps the operational area. Aerial

surveys and tagging studies of humpback whales indicate that most migrating humpbacks occur in deeper water than the operational area (ranging from approximately 95–125 m), (Double et al., 2012, 2010; RPS Environment and Planning, 2010; Thums et al., 2018). However, their presence within the operational area is not expected to be significant as there is no main aggregation area. The operational area does not have any constraints that would prevent humpback whales from moving away from vessels.

Collision/vessel strike is also identified as a threat to the Southern Right Whale in the National Recovery Plan for the Southern Right Whale However the BIA for the Southern Right whale is 240 km from the operational area and does not overlap the EMBA. Hence the risk of vessel collision with the Southern Right Whale is unlikely. Similarly, collision threat is identified in Conservation Advice for Australian snubfin dolphin and Australian humpback dolphin and requires any vessel strike to be reported. However, there is no BIA for these two species and any interaction is expected to be limited to individuals.

The most severe impact from vessel collision or entanglement would be the death or serious injury of an individual. Collisions between vessels and cetaceans are more common in areas where high vessel traffic and cetacean habitats overlap (WDCS, 2006). There have been recorded instances of cetacean deaths in Australian waters due to vessel collisions (e.g. a Bryde's whale in Bass Strait in 1992) (WDCS, 2006), although these are primarily associated with container ships and fast ferries. The Whale and Dolphin Conservation Society also indicates that some cetacean species, such as humpback whales, can detect and change course to avoid a vessel (WDCS, 2006). The reaction of whales to the approach of a ship is quite variable. Some species remain motionless when in the vicinity of a ship while others are known to be curious and often approach ships that have stopped or are slow-moving, although they generally do not approach and sometimes avoid faster-moving ships (Richardson et al., 1995).

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 & Silber, 2003). Laist et al. (2001) suggest the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster.

The operation of vessels, ROVs, and divers is highly unlikely to impact on the migration routes of whales (in particular the humpback whale, which passes close to Barrow and Montebello islands between June and September. The Listing Advice for *Megaptera novaeangliae* (Humpback Whale) (TSSC, 2022) identifies vessels as a threat. Although some level of disturbance may occur, this is likely to be primarily caused by underwater noise from vessels and ROVs within the operational area (Section 6.2), rather than their physical presence.

Dugong are known to occur in and around seagrass growth areas and to exhibit some stereotypical inquisitive behaviours (Anderson, 1982). Though they are migratory, some species habitat is likely to occur within the region. Risk of strike depends on the movements of both the vessels and the dugong. The risk of dugong strike can be lowered significantly by minimising movements directly over seagrass beds in shallow waters.

7.2.2.3 Fish and sharks

Given the operational area is 20 km from a whale shark foraging BIA (Table 3-10 or Figure 3-10), individuals may be encountered during the activity. However, large numbers of whale shark encounters are not expected, given the BIA is approximately 80 km wide at this location, extending predominantly through deeper waters and with the nearest whale shark aggregation site approximately 280 km from the operational area. Boat strike is recognised by the Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015b) as one of the threats to their recovery. Whale sharks, other pelagic fish and demersal fish are likely to exhibit a short-term avoidance to vessels, divers or ROVs. This is likely to be initiated through the vibrations and underwater noise emitted from these activities (Section 6.2) rather than the physical presence. Such avoidance is likely to be temporary.

Demersal fish that associate with reef and hard substrate areas are likely to be attracted to the artificial habitat created by the subsea pipeline, although, on a population level, this attraction is unlikely to be significant in terms of redistributing the abundance of fishes. This artificial habitat may increase the local survival and recruitment of some demersal fishes, although again this is unlikely to be significant on a population or ecosystem level given the small area of infrastructure and the existence of natural hard substrate and reef habitats nearby (particularly adjacent to the Montebello, Barrow and Lowendal islands).

Pelagic and demersal fish are likely to exhibit a short-term avoidance to vessels, divers or ROVs. This is likely to be initiated through the vibrations and underwater noise emitted from these activities (Section 6.2) rather than the physical presence. Such avoidance is likely to be temporary.

7.2.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed fauna during activities [EPO-DC-01].

The control measures considered for this event are shown in Table 7-3, with EPS and measurement criteria for the EPO described in Table 8-2.

Table 7-3: Marine fauna interaction – Control measures evaluation

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-03	Procedure for interacting with marine fauna	Administrative	Reduces risk of physical and behavioural impacts to marine fauna from vessels, helicopters and drones because if they are sighted, vessels can slow down, or move away, and helicopters and drones can increase distances from sighted fauna if required.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel, helicopter and drone speed and direction, are based on legislated requirements and must be accepted. Cost of purchasing and making guards; creation of drag of ROV in water slows down activity. Some training required to alert ROV users to change in management procedure for work class ROV equipment.	**Adopted** – Benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos.
DC-CM-17	Constant bridge watch on support vessels.	Administrative	Monitoring of surrounding marine environment to identify potential collision risks (and reducing harm) to cetaceans and other marine fauna.	No additional cost; industry practice and regulated by AMSA.	**Adopted** – Industry practice, benefits outweigh cost.
Additional Control Measures					
N/A	Restrict the timing of activities to operate only outside of sensitive periods.	Isolation	Reduce risk of collisions (causing harm) during environmentally sensitive periods for listed marine fauna.	Protected marine fauna species are present year-round, meaning there are no non-sensitive periods to operate in.	**Rejected** – Grossly disproportionate to the environmental benefit and would severely limit operations which are required to occur 24 hours a day, 7 days a week.
N/A	Dedicated marine fauna observer on support vessels.	Administrative	Improves ability to spot and identify marine fauna at risk of collision (that may cause harm).	Additional cost of contracting several specialist marine fauna observers.	**Rejected** – Grossly disproportionate to the environmental benefit and would severely limit operations, which are required to occur 24 hours a day, 7 days a week.
N/A	Activities will only occur during daylight hours.	Elimination	Potential for a vessel-fauna collision occurring is decreased due to vessel being stationary when visibility is lower at night.	Lengthens time of the activity as operations only continue for approximately 10 hours/day or less in winter. Increased cost due to increased operation time (more than double the cost and therefore grossly disproportionate).	**Rejected** – Substantial additional cost due to doubling of activity duration. No overall environmental benefit as it results in increased impacts and risks.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
N/A	Adopt further measures to those outlined in 'EPBC Regulations 2000 — Part 8 Division 8.1' during peak periods of ecological sensitivity, e.g. additional management considerations for vessels outlined in the Australian National Guidelines for Whale and Dolphin Watching (2017).	Administrative	Potentially provide an additional level of protection of marina fauna.	Administrative costs to update existing procedure. Operational costs through interruption to activities through implementation of controls developed for an industry trying to get close to marine fauna, when Santos' activities aim to avoid fauna.	**Rejected** – The existing control 'procedure for interacting with marine fauna' has been written in accordance with the EPBC Act and other relevant guidelines. A review of this procedure against the Australian National Guidelines for Whale and Dolphin watching found that there are no additional relevant controls in the Australian National Guidelines for Whale and Dolphin watching and therefore adopting this control is not ALARP.

7.2.4 Environmental impact assessment

Marine Fauna Interaction	
Receptors	Threatened, migratory or local fauna
Pre-treatment consequence	III – Moderate
Consequence	III – Moderate
In the event of a collision with fauna, there is the potential for injury or death of an individual. The number of receptors present in the operational area during the intermittent inspection and maintenance activities is expected to be limited to a small number of transient individuals. The likelihood of lethal collision depends on the number of animals in the vicinity of vessel operations, the probability of a fauna collision and the severity of damage caused by that collision. Given that the support vessels will move slowly (less than 5 knots) within the operational area and that the activity is of short duration, the risk of fauna collision is extremely low. Consequences will be limited to, at worst, injury or mortality of individuals of any species. Boat strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice. The above information demonstrates that, with control measures in place, the activity will be conducted in a manner that reduces potential impacts to ALARP and an acceptable level. There is the potential for death or injury of EPBC Act-listed individual species; however, as they would represent an individual within the local population, it is not expected that it would result in a decreased population size over what would usually occur due to natural variation, at a local or regional scale; it is expected that the loss of an individual would be a moderate consequence.	
Likelihood	c – Possible
The operational area overlaps whale migration pathways; thus, migrating individuals may traverse the operational area. No known aggregation areas (breeding, resting, or calving) occur within the operational area; therefore, concentrations of milling individuals are unlikely. Vessels will be moving very slowly while inside the operational area, posing a low risk of collision with marine fauna. In addition, the noise generated from vessel operations may locally deter marine fauna from coming near vessels. Consequently, the likelihood of a collision with marine fauna is Possible.	
Residual Risk	Low

7.2.5 Demonstration of ALARP

The DC supply pipeline is a fixed structure that has been in place since 2011. The continued presence of this infrastructure is unlikely to impact on marine fauna or cetacean migration as the infrastructure is fixed in place and does not prevent or obstruct the movement of marine fauna in the area.

Any impact caused by the physical presence of the DC supply pipeline is likely to be localised and temporary, with marine species expected to resume normal behavioural patterns in the open oceanic waters surrounding the operational area in a short time frame.

The use of support vessels in the field is necessary for the safe and efficient operation of the DC supply pipeline. Without vessels providing support for operational activities via subsea inspections, and maintenance, the risk of equipment failure leading to a safety or environmental incident is increased. Therefore, elimination of subsea equipment inspection activities or supply transfer to eliminate the risk of marine fauna collision is not considered practicable.

The frequency of subsea inspections has been determined for the safe operational duration to proactively prevent equipment failure based on Santos' experience on the NWS. Therefore, the frequency of vessels required in the field is considered ALARP, based on the required safe operation and maintenance requirements of the pipeline.

In the event that vessels come in close proximity to EPBC Act-listed marine fauna, such as whales and whale sharks, environment performance standards have been implemented for limiting vessel operations, as well as for ensuring the crew are aware through inductions of the risk posed by conducting the activity, in order to reduce the likelihood of a marine fauna collision to ALARP.

The inherent likelihood of encountering fauna in the operational area is limited by the short duration of the activities and the separation from areas of high surface fauna density. With low vessel speeds and compliance with fauna interaction procedures, including Regulation 8 of the EPBC Regulations 2000, which aim to prevent adverse interactions of vessels with marine megafauna, a fauna collision is considered very unlikely. With the controls adopted, the assessed residual risk for this impact is ALARP.

7.2.6 Acceptability evaluation

Is the risk ranked between VeryLow to Medium?	Yes – Maximum marine fauna interaction residual risk ranked Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with Part 8 of the EPBC Regulations. Control measures implemented will minimise the potential risks and impacts from vessel strike from the activity to relevant species identified in recovery plans and conservation advice (Table 3-11).
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Application of the proposed management controls and adherence to regulations reduces the likelihood of vessel interactions with marine fauna. While the potential exists for a collision to occur, it is considered a rare scenario. Vessels will typically be travelling at low speeds within the operational area when undertaking activities, further reducing the likelihood of fauna strike. In the unlikely event that an impact did occur, it would be highly probable that only a single individual would be contacted; therefore, the impact is considered to be ALARP and environmentally acceptable.

7.3 Release of solid objects

7.3.1 Description of event

Event	Solid objects such as those listed below can be accidentally released to the marine environment during operations, IMMR and CoP activities: • Non-hazardous solid wastes (e.g. paper, plastics and packaging) • Hazardous solid wastes (e.g. batteries, fluorescent tubes, medical wastes, and aerosol cans)

	• Equipment and materials (e.g. hard hats, tools or infrastructure parts). Release of these waste streams may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfers of waste or dropped objects/lost equipment.
Extent	The event will only occur within the operational area, and all non-buoyant waste material or dropped objects are expected to remain within the operational area. Buoyant objects could potentially move beyond the operational area.
Duration	An unplanned release of solids may occur during operational, IMMR and CoP activities.

7.3.2 Nature and scale of environmental impacts

Potential Receptors: Benthic habitats, fish and sharks, marine mammals, marine reptiles and seabirds

Physical environment

Objects accidentally dropped to the seabed could occur during the activity, such as the transfer and lifting of objects and equipment. Equipment and other items lost at sea could be caused by crane failure, adverse weather, human error, rigging failure and vessel motions and potentially could lead to loss of or changes to benthic habitats. The area of potential disturbance from a non-buoyant dropped object would be restricted to the area in which it was dropped. In the unlikely event that seabed equipment being recovered is dropped to the seabed, disturbance to benthic habitat would occur, the area of which will be confined to the footprint of the equipment. Potential for the object to be recovered may take time but would be less than one year).

The potential for benthic habitat damage would be greatest over sensitive seabed features, which within the DC supply pipeline permit area, could comprise filter-feeding communities including sponges, soft corals, gorgonians, seagrasses and other sessile. The intertidal zone contains some significant benthic habitat, though the pipeline has been buried using HDD, and pipeline inspection of this section typically relies on feedback information from intelligent pigging.

While soft sediment benthic habits will not be destroyed, disturbance of the communities on and within them (i.e. the epifauna and infauna) will occur in the event of a dropped object; and depressions may remain on the seabed for some time after removal of the dropped object as they gradually infill over time.

Impacts to benthic communities from dropped object disturbance are expected to be short term in duration due to the ability for such communities to recover. Recovery is expected within 6–12 months, based on previous surveys (URS, 2010).

Small buoyant dropped objects have the potential to be transported by marine currents and may impact on reefs, islands, shoals and banks within the region. Accidentally dropped objects, such as plastics, have the potential to smother benthic environments, and the release of hazardous solids (e.g. wastes such as batteries) could also impact water quality through pollution of the immediate receiving environment. Impacts from accidentally released liquids are discussed in Section 7.4.

Threatened, migratory or local fauna

Solids such as plastics have the potential to affect benthic environments and to harm marine fauna through entanglement or ingestion. Marine turtles and seabirds are particularly at risk from entanglement. Once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fatality (Derraik, 2002). Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fauna fatality. Floating, non-biodegradable marine debris has been highlighted as a threat to marine turtles, whales (including the Southern Right Whale), whale sharks, and albatrosses and giant petrels in the relevant recovery plans and approved conservation advice (refer to Table 3-11). The recovery plans and approved conservation advice, as well as the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018), have specified a number of recovery actions to help combat this threat. Of relevance to this event is the legislation for the prevention of garbage disposal from vessels. As the WHP is an unmanned platform and vessel activity is infrequent, the risk from small plastics is diminished.

Release of hazardous solids (e.g. wastes such as batteries) may result in the pollution of the immediate receiving environment, leading to detrimental health impacts to marine flora and fauna. Physiological damage can occur through ingestion; or absorption may occur in individual fish and sharks, marine mammals, marine reptiles or seabirds.

AUVs utilise acoustic doppler measurements to detect and prevent seafloor contact; and in the event of low power, they are designed to float to the surface and transmit their position for recovery reducing the potential for impact with the seabed.

Socio-economic receptors

Tourism activities, such as snorkelling, diving, surfing and recreational fishing are not expected to occur in the operational area, given the water depth, lack of seafloor features and distance from shore. Although dropped solid objects have potential to float to nearby areas used for tourism or recreational purposes solid non-hydrocarbon releases are not expected to occur frequently or to a scale that may cause significant pollution that would impact the socio-economic values of these areas. Impacts to socioeconomic receptors could occur should debris interfere with other marine users or their equipment (for example, fishing nets).

In waters nearer to shore there is the potential for a dropped object to become a snag for recreational or commercial fishing activities in the area. Given the type of objects considered, and the existence of intermittent coral structures in the vicinity, and the charted pipeline, the increase to snagging risk in the area is considered negligible.

7.3.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- No unplanned objects, emissions or discharges to sea or air [EPO-DC-07].

The control measures considered for this event are shown in Table 7-4, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 7-4: Release of solid objects – Control measures evaluation

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-05	Vessel planned maintenance system.	Administrative	Requires that lifting equipment is maintained and certified and that lifting procedures are followed, reducing probability of dropped objects occurring.	Additional personnel costs of ensuring equipment is maintained and certified as appropriate and that procedures are in place and followed.	**Adopted** – Benefits of ensuring procedures are followed and equipment is compliant outweigh the minimal costs of personnel time.
DC-CM-24	Waste (garbage) management procedure.	Administrative	Reduces probability of garbage (waste) being accidentally discharged to sea, reducing potential impacts to marine fauna. Complies with Marine Order 95, Marine Pollution Prevention – Garbage. Garbage generated on vessels will not be disposed to the marine environment	Personnel cost of vessel audits and inspections, and in reporting discharge levels.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time, and it is a legislated requirement.
DC-CM-27	General chemical management procedures.	Administrative	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.	Personnel costs associated with ensuring procedures are in place and implemented during handling and storage of chemicals.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
DC-CM-33	Dropped object prevention procedures	Administrative	Impacts to environment are reduced by preventing dropped	Personnel costs involved in implementing	**Adopted** – Benefits of ensuring procedures are

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
			objects and by retrieving dropped objects unless the environmental consequences are negligible or there are risks to safety. Ensures lifting equipment certified and inspected.	procedures and in incident reporting.	followed and measures implemented outweigh the costs of personnel time.
DC-CM-34	Hazardous chemical management procedures.	Administrative	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
DC-CM-35	Santos Refuelling and Chemical Transfer Standard (SO-91-IQ-00098	Administrative	Minimises risk of pollution to ALARP during hydrocarbon transfers/ vessel refuelling.	Personnel costs associated with ensuring procedures are in place and implemented during refuelling and chemical transfers.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
Additional Controls					
N/A	Eliminate lifting in field	Eliminate	Reduces the risk of releasing non-hydrocarbon solid to the marine environment due to dropped object.	Eliminating lifting would require support vessels storing more equipment and supplies on-board, and/or additional trips to shore. Support vessels will not have enough deck space to store all required equipment, materials and supplies needed for the duration of the activity, without compromising occupational health and safety.	**Rejected** – Not feasible to eliminate lifting in the field.
N/A	Eliminate transfers during night-time activities.	Eliminate	Reduces risk of not seeing any dropped objects during transfers.	Reducing the window for lifting would potentially limit the activity considerably due to the tide restrictions in the area.	**Rejected** – Not feasible to eliminate lifting in the field over 24 hours.

7.3.4 Environmental impact assessment

Description – Release of Solid Objects	
Receptors	**Physical environment and habitats (benthic)**
Pre-treatment consequence	II – Minor – for smaller windblown waste i.e. hard hats that would float
	III – Moderate – for larger items that would sink
Consequence	II – Minor – for smaller windblown waste i.e. hard hats that would float

	III – Moderate – for larger items that would sink
Physical Environment – Seabed disturbance Non-buoyant dropped objects are expected to impact the seabed and be limited to the size of the dropped object, and given the size of standard materials transferred, any impact is expected to be very small and limited to within the operational area in which it was dropped. In the unlikely event that seabed equipment being recovered is dropped to the seabed, disturbance to benthic habitat would occur, the area of which will be confined to the footprint of the dropped equipment. Any area of the seabed impacted through dropped objects would be expected to recover. Consequently, any impacts are predicted to be short-term in nature. Previous surveys indicate the seabed is likely to comprise habitats which are well-represented within the broader region (refer to Section 3.2.3). Small, dropped objects have the potential to smother benthic habitats of they eventually sink and could wash up on island beaches. It is considered that the application of management measures will effectively prevent this impact occurring on a significant scale. Therefore, impacts will result in a II – Minor reduction in habitat area or function. Any impact to the seabed through dropped objects would result in a minor reduction in habitat area or function impacted assuming a large item of equipment is lost overboard and drops to the seabed.	
Marine Fauna – Cetaceans, marine turtles, seabirds, fish and sharks In the event of loss of a solid object, the quantities would be limited by the petroleum activities defined in Section 2. The release could cause localised impacts to water quality and the benthic environment. If the solid object can be ingested by marine fauna, impacts would be restricted to a small number of individuals, if any. Ingestion of hazardous solid wastes by marine fauna could occur in small quantities. Impacts from ingestion may occur to a small number of individuals, if any. No consequences for conservation status or reproductive success of cetaceans, marine turtles or fish species that may occur in the area are expected. Only small volumes of solids would be generated during the activity, as a result, any accidental loss to the environment would be small in size. Any impacts would be restricted to a small number of individuals, if any. Relevant recovery plans and conservation advice have identified marine debris as a potential threat. There is a Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018). As such there is the potential for impacts only to a small proportion of a local population with no consequences for conservation status or reproductive success of cetaceans, marine turtles or fish species that may occur in the area. The limited quantities associated with this unplanned event indicate that even in a worst-case release of solid waste, the number of fauna fatalities would be limited to individuals and is not expected to result in a decrease of the local population size. Therefore, the consequence is III – Moderatefor large objects and II – Minor for smaller objects.	
Socio-economic receptors (tourism and recreation) In the event of a release of a buoyant object that cannot be recovered, it could present an obstacle to other marine users. Eventually the buoyant object may become non-buoyant and sink to the seabed where it may degrade over time. The time taken for this is dependent on the material released and any impacts to marine fauna and the seabed are described above. This may present a risk to commercial trawling activities and damage their equipment, so fishers may be required to avoid a highly localised area to avoid interaction. Given the likely size of buoyant equipment (i.e. storage drum), it will drift with the currents. It is considered unlikely to present a significant hazard to other marine users and the consequence level is therefore II- Minor. Impacts to tourism and recreation have the potential to occur through buoyant objects floating into areas used for these activities, adversely impacting tourism and recreation values and creating poor aesthetics. Given the limited quantities associated with this unplanned event, even a worst-case release of solid waste is unlikely to have flow-on effects significant enough to impact the tourism and recreation industries. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. Therefore, the consequence is I-Negligible	
Likelihood	c - Possible for smaller windblown waste i.e. hard hats that would float
	b –Unlikely- for larger items that would sink
Control measures proposed ensure that the risk of solid objects to the environment has been minimised. The likelihood of transient marine fauna occurring in the operational area coincident with a release is Unlikely; and given the control measures in place and the infrequency of personnel and vessels in the operational area, the likelihood of a loss of solid objects resulting in a consequence greater than moderate is considered Unlikely (assumes potential for a single loss of solid waste event during the activity). For smaller objects the likelihood of transient marine fauna occurring in the operational area coincident with a release is limited; and given the control measures in place, the likelihood of releasing solid objects to the environment resulting in a greater than minor consequence is considered Possible (assumes potential for some losses of small items such as plastic packaging, hard hats, water bottles).	
Residual Risk	Low

7.3.5 Demonstration of ALARP

The control measures proposed reduce the residual risk of their release to Low, and this cannot be reduced further with any reasonably practicable additional control measures. The potential unplanned impacts in this scenario are considered ALARP.

The frequency of subsea inspections has been scheduled for the safe operational duration to proactively prevent equipment failure based on Santos' experience on the NWS. Decreasing inspections and maintenance will require increases in the duration and complexity of maintenance activities. This frequency of subsea inspections is considered ALARP, based on the required safe operation and maintenance requirements of the pipeline.

If an object is dropped, the incident will be responded to in accordance with the implementation strategy for incident response. With the above controls in place, Santos considers the risk of a dropped object is ALARP.

Controls for reducing the likelihood of dropped objects occurring through ensuring equipment is maintained to prevent poorly operating equipment and/or breakdowns/failures leading to dropped objects. In addition, by complying with lifting procedures, the likelihood of dropped objects from lifting activities is reduced. Also, noting that the transfer of material is not expected for DC supply pipeline operations activities; this activity and risk is included within this EP for conservatism.

Based on offshore pipeline inspection equipment being comparatively small, in the area for a short duration (approximately 5 days), and usually only occurring on an annual or less frequently, no additional controls have been identified which could further reduce this environmental risk posed by dropped objects.

7.3.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – Release of solid objects residual risk ranking is Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with MARPOL Annex III. Control measures implemented will minimise the potential impacts from the activity to species identified in recovery plans and approved conservation advice as well as the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018) as having the potential to be impacted by non-hydrocarbon surface releases of solid objects. Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11. • Yes – management consistent with Marine Order 95. 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. • Specific actions that contribute to the long-term prevention of marine debris (Objective 1 of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE 2018)) have been adopted, including compliance with applicable legislation in relation to the improvement of waste management practices
'Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

Potential environmental impacts from a dropped object would most likely be minor and related to indents in the soft sediment habitat within the operational area. Given the sediment habitat is expected to recover relatively rapidly (within 6–12 months), the potential impacts are considered environmentally acceptable. Through implementation of the proposed management controls, the risk of dropping an object is reduced to a level that is considered acceptable.

With the controls in place, which align with relevant actions prescribed in the Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018) to prevent accidental release of solid objects, and the III – Moderate impact predicted to marine fauna as a result of the low risk of release of a large solid object to the environment is considered to be ALARP and Acceptable.

7.4 Hazardous liquid releases (marine environment)

7.4.1 Description of event

Event	Causes for accidental liquid releases (other than diesel and condensate spills from maximum credible spill during operations, IMMR and CoP activities include: • Hydraulic fluids, lubricant oils and stored waste oils from: – ROV failure (including oil seal, hydraulic system hose and quick disconnect system failures) – Loss of primary containment (e.g. drums, tanks, intermediate bulk containers (IBCs)) due to handling, storage and dropped objects (e.g. swinging load during lifting activities) – Vessel pipework failure or rupture, hydraulic hose failure and inadequate bunding. • Chemicals, including cleaning and cooling agents, recovered solvents, stored or spent chemicals, leftover paint materials and used greases through: – Bunkering from tote tanks to bulk tanks or transferring to day tanks or due to component failure, such as flexible hoses – Spills or leaking machinery accidentally discharged overboard in deck drainage water – Overflow of the open and closed drainage systems – Loss of primary containment (e.g. drums, tanks and IBCs) due to handling, storage and dropped objects (e.g. swinging load during lifting activities). The supply vessel main engines and equipment, such as pumps, cranes, winches, power packs and generators, require marine diesel oil (MDO for fuel and a variety of hydraulic fluids and lubricating oils for efficient operation and maintenance of moving parts. These products are present within the equipment and also held in storage containers and tanks on supply vessels. Small hydrocarbon leaks could occur from loss of primary containment due to handling, storage and dropped objects (during lifting activities). Volumes are likely to be small and limited to the volume of individual containers (e.g. IBC, 44-gallon drums) stored on the deck of supply vessels. The credible spill for this scenario is considered to be the loss of an IBC (1 m^3) during transfer between vessels. ROV operations can result in unplanned discharges (of hydraulic fluids) directly to the marine environment due to equipment failure, ROV interactions with the vessel thrusters and/or accidental contact with subsea infrastructure. The largest credible hydrocarbon spill from ROV operations would be an accidental release of approximately 0.05 m^3 (50 L) of hydraulic fluid from the deployed ROV. Minor accidental loss of other hydrocarbon-based liquids (e.g. used lubricating oils, cooking oil and hydraulic oil) to the marine environment could also occur via tank pipework failure or rupture, hydraulic hose failure, inadequate bunding or storage, insufficient fastening or inadequate handling which could result in impacts to water quality and hence sensitive environmental receptors. Oily water from vessels includes bilge water and deck drainage water. In the event that the oil detection monitoring equipment fails, water containing hydrocarbons at greater than 15 ppm could be accidentally discharged overboard. Release could also occur from transport of chemicals on support vessels (i.e. dropped objects or leak or spill from transfer hose).
Extent	The relatively low volumes are expected to rapidly disperse into the marine environment. Concentrations below toxic or harmful thresholds are expected to occur at short distances from the release point. Should a spill occur, potential impacts beyond the operational area are not expected in the event of a worst-case spill.
Duration	Potentially toxic or harmful threshold concentrations limited to a very short period immediately following release during operational, IMMR and CoP activities.

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, fish and birds) and socio-economic receptors (commercial fishing, tourism and recreation).

Physical environment

Non-hydrocarbon liquids or chemicals released to the marine environment may lead to contamination of the water column in the vicinity of the release location. 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.

Hydraulic fluids and lubricating fluids behave similarly to marine diesel when spilt in the marine environment. Hydraulic fluids are oils of light to moderate viscosity and have a relatively rapid spreading rate. Like diesel, they will dissipate quickly, particularly in high sea states, although lubricating oils are more viscous and so the spreading rate of a spill of these oils would be slightly slower.

Impacts associated with the unplanned discharge of hazardous liquids to the marine environment depend on the nature of the liquid released, the volume and its behaviour in the marine environment (i.e. whether it sinks, floats, disperses, etc.). In the event of a spill to the marine environment, these liquids would be subjected to rapid dispersion and dilution by the open ocean water conditions and prevailing currents.

Potential impacts include a temporary and highly localised decline in water quality. This would have limited potential for toxicity to marine fauna, due to the likely short duration of exposure and rapid dilution of the released hazardous liquids in the marine environment. Impacts are likely to be limited to the immediate vicinity of the spill and would not affect population viability of contacted species or ecosystem function. For small hydrocarbon-based releases, the environmental impacts are expected to be minimal but may include a visual sheen and a slight oiling of wildlife within the first few hours following the spill if conditions are calm.

Due to the small 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 reefs, and offshore islands. There is no emergent or intertidal habitat that could be impacted by a small surface spill. Owing to the location, any spilled material is unlikely to reach land or affect any of benthic habitats.

Threatened or migratory species

Changes to water quality could potentially lead to short-term impacts on marine fauna (e.g. pelagic fish and sharks, marine mammals, marine reptiles and seabirds). As summarised Table 3-10, the operational area overlaps with BIAs for humpback whales, turtles and seabirds.

Recovery plans and conservation advice for numerous bird species identify marine pollution and contamination impacts as a threat to the species. In addition, the Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017) identifies deteriorating water quality as a threat to all species of marine turtles in Australia. These species have been identified as potentially transiting through the operational area from time to time due to overlap with BIAs and critical habitat.

Chemical spills are unlikely to have widespread ecological effects on threatened or migratory fauna, given the nature of the chemicals on board, the small volumes that could be released, and the open-ocean environment of the location. 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 toxic chemicals are considered unlikely, given the expected low concentrations and short exposure times.

Socio-economic receptors

Given the localised and temporary impacts of an unplanned hazardous liquid spill, any impact to commercial fishing, tourism and recreation activities is considered unlikely.

7.4.3 Environmental performance objectives and control measures

The EPO relating to this event is:

- No unplanned objects, emissions or discharges to sea or air [EPO-DC-07].

The control measures considered for this event are shown in Table 7-5, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 7-5: Hazardous liquid releases – Control measures evaluation

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-13	Planned subsea and offshore maintenance.	Administrative	Reduces likelihood of leaks from equipment and ensures ongoing integrity of subsea infrastructure	Personnel and operational costs associated with undertaking regular inspections of all subsea equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-26	Chemical selection procedure.	Administrative	Reduced toxicity to marine environment. Only environmentally acceptable chemicals would be released in the event of an accidental discharge to sea.	Cost associated with implementation of procedure. Range of chemicals reduced but potentially higher costs. Potential additional cost and delays of chemical substitution.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweighs costs.
DC-CM-27	General chemical management procedures.	Administrative	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.	Personnel costs associated with ensuring procedures are in place and implemented during handling and storage of chemicals.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
DC-CM-28	Scupper plugs will be available for deployment in the event of a spill to prevent deck drainage.	Isolation	Reduces potential impacts of contaminants being discharged to sea.	Increased health and safety risks from wet deck not draining. Large amounts of water on a vessel's deck can also cause stability issues (free-surface effect)	**Adopted** – benefits of preventing dreck drainage outweighs safety risk.
DC-CM-30	Vessel spill response plan (SOPEP)/SMPEP).	Administrative	Implements response plans on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order to reduce impacts to the marine environment.	Administrative costs of preparing documents. Plan generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/ SMPEP is in place.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-33	Dropped object prevention procedures	Administrative	Impacts to environment are reduced by preventing dropped objects and by retrieving dropped objects unless the environmental consequences are negligible or there are risks to safety. Ensures lifting equipment certified and inspected.	Personnel costs involved in implementing procedures and in incident reporting.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs of personnel time.
DC-CM-34	Hazardous chemical management procedures.	Administrative	Reduces the risk of spills and leaks (discharges) to sea by controlling the storage, handling and clean-up.	Personnel cost associated with implementation of procedures and permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.

Ref. No	Control Measure	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-35	Santos Refuelling and Chemical Transfer Standard (SO-91-IQ-00098	Administrative	Minimises risk of pollution to ALARP during hydrocarbon transfers/ vessel refuelling.	Personnel costs associated with ensuring procedures are in place and implemented during refuelling and chemical transfers.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
DC-CM-36	Maritime Dangerous Goods Code	Administrative	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	Cost associated with implementation of code/procedure.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh costs.
DC-CM-37	ROV inspection and maintenance procedures	Administrative	Maintenance and pre-deployment inspection on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to the marine environment.	Additional personnel costs of ensuring procedures in place and followed.	**Adopted** – Benefits of ensuring procedures are followed outweigh costs.

7.4.4 Environmental impact assessment

Hazardous Liquid Release (Marine Environment)	
Receptors	Threatened, migratory or local fauna Physical environment or habitats
Pre-treatment consequence	I – Negligible
Consequence	I – Negligible

In the event of a minor hydrocarbon or chemical spill, the quantities would be very small (worst-case identified to be limited to approximately 1 m^3 for the loss of the contents of an IBC, or 50 L for ROV hydraulic fluid). The small volumes and dilution and dispersion from natural weathering processes such as ocean currents are such that spills will be limited in area and duration. The number of receptors present along the DC supply pipeline are expected to be limited to a small number of transient individuals.

The susceptibility of marine fauna to hydrocarbons and chemicals is dependent on type and exposure duration. However, given exposures would be limited in extent and duration, exposure to marine fauna from this hazard is considered to be low. The small volumes of worst-case discharges are such that the impacts to receptors will decline rapidly with time and distance at the sea surface. Rapid dilution at depth would also result in the impacts to receptors declining rapidly with time and distance.

Habitat degradation, deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species, including turtles and some bird and shark species, in relevant recovery plans and conservation advice (Table 3-9). However, the potential releases of hazardous liquids are not expected to significantly impact the receiving environment, given the control measures proposed to prevent releases; therefore, the activity will be conducted in a manner that is considered acceptable.

For marine species that may be exposed to the more toxic aromatic components of spilled hydrocarbons, toxic effects are considered unlikely since these species are mobile and therefore will not be constantly exposed for extended durations that would be required to cause any major toxic effects.

Although humpback and blue whales may be exposed, this event is not expected to interfere with their migration activity. Toxic impacts are not expected to the benthic community due to the water depths.

Near the sea surface, fish are able to 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). Pelagic fish species are therefore generally not highly susceptible to impacts from chemical spills. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long

Hazardous Liquid Release (Marine Environment)	
periods in this spill scenario. The more toxic components would also rapidly evaporate, and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. The highly dispersive waters of the operational area with strong drift current and local scale currents (average and maximum surface current speeds of 0.30 m/s and 2.51 m/s respectively, RPS 2024)), will limit impacts to short-term water quality impacts and possible temporary behavioural effects observed in fish, sharks and seabirds. Deteriorating water quality is identified as a potential threat to turtles in the marine turtle recovery plan and to some bird and shark species (Table 3-9). However, the potential minor hydrocarbon or chemical releases are not expected to significantly impact the receiving environment, given the control measures proposed to prevent releases. Therefore, the activity will be conducted in a manner that is considered acceptable. Given that a small hydrocarbon or chemical spill would not result in a decreased population size at a local or regional scale, it is expected that a spill of this nature would result in a Negligible consequence.	
Likelihood	b –Unlikely
A small hazardous liquid release is unlikely to have widespread ecological effects, given the nature of the chemicals on board, the small volume that could be released, the depth and transient nature of marine fauna in this area, and the prevention and management procedures in place to clean up a spill. Santos reviewed non-hydrocarbon liquid spills and leaks from equipment and machinery in recent history (due to split hoses, small leaks, or handling errors). Most of the spills and leaks reported occurred within bunded areas, were less than 100 L, did not reach the marine environment and were cleaned up immediately. The likelihood of a small hazardous liquids release occurring is limited, given the set of mitigation and management controls in place for this program. Consequently, the likelihood of releasing hazardous liquids to the environment, which results in a minor consequence, is considered to be b-Unlikely.	
Residual Risk	Very Low

7.4.5 Demonstration of ALARP

Storage and use of hydraulic and lubricating oils or fluids for equipment and machinery, including for ROV operations, are required to undertake the activity, so their removal from the activity is not viable.

The generation of hazardous liquid wastes is unavoidable during some maintenance activities. However, less toxic chemicals can be substituted for some hazardous liquids. This is done by having all chemicals go through the Santos Chemical Selection process, in order that low toxicity chemicals are preferentially used over more hazardous types, where practicable.

In addition, administrative controls, such as all vessels being required to have a Garbage Management Plan that describes the on-board controls for preventing unplanned discharges, will minimise the risk of the hazardous liquid being accidentally discharged through mishandling or poor storage.

Other management controls that have been implemented include designated storage and handling areas, use of material safety data sheets, spill clean-up equipment and procedural controls (e.g. employee inductions and lifting and handling training), not only to minimise the risk of an accidental release, but also to reduce the impact in the event that a release does occur.

A thorough set of control measures has been proposed to ensure the risks of minor hazardous liquid spills and leaks occurring and subsequent impacts are minimised. The resulting impacts to marine fauna that could potentially result from a spill of this size would be minor, with impacts restricted to a small number of individuals within a localised area.

The control measures proposed are in line with applicable actions described in relevant recovery plans and conservation advice to reduce the risk of habitat degradation and deteriorating water quality (e.g. from pollution) to a level considered to be ALARP by Santos. The assessed residual risk for this impact is low and cannot be reduced further. It is considered therefore that the impact of the activities conducted is ALARP.

7.4.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – Maximum minor hydrocarbon spill residual risk is ranked Very Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.

Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with International Convention of the Safety of Life at Sea (SOLAS) 1974 and the *Navigation Act 2012*, MARPOL Annex I – Oil. Consistent with relevant species recovery plans, conservation management plans and management actions set out in Table 3-11
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

With the control measures in place to prevent an accidental release of small hydrocarbon and non-hydrocarbon liquids and chemicals, and the negligible impacts predicted from unplanned spills, the risk to the marine environment is considered very low. Potential risks are unlikely to be greater than those caused by other commercial marine vessels or offshore petroleum activities in deep water.

Hazardous liquids will be managed in accordance with relevant legislation and industry standards and Santos procedures. The small volume negates the need for any further contingencies to be in place that are included for some of the larger spill scenarios associated with the activity.

With the control measures in place to prevent accidental spills and the negligible impacts predicted from a spill of this size, the environmental risk of using and handling the required chemicals is considered acceptable.

7.5 Terrestrial flora and fauna interaction

7.5.1 Description of event

Event	Terrestrial flora and fauna interaction could occur due to: • Potential fauna strikes due to vehicle inspections of pipeline corridor. • Erosion caused by access to onshore operational area or presence of the pipeline. • Potential for contribution to the spread of weed species, or interactions with protected flora species. • Potential fire may cause mortality or injury to fauna, vegetation and habitat damage. • Potential exposure of acid sulphate soils. • Fauna entrapment during excavation. Note: there are no situations envisaged to occur in the next 5 years where planned routine excavation will be required within the pipeline corridor. However, excavations may be required because an issue has been identified through results of ongoing maintenance such as pigging.
Extent	Routine pipeline inspections are undertaken infrequently, in daylight hours. Localised to within DC pipeline corridors.
Duration	During operations, IMMR and CoP activities.

7.5.2 Nature and scale of environmental impacts

Potential receptors: Terrestrial flora and fauna along the onshore operational area

7.5.2.1 Vehicle interactions

While there are Department of Transport mandated speed limits on Forty Mile Beach Road for all vehicles, there is the potential for occasional fauna strikes (i.e. reptiles during the day and nocturnal fauna during the night). All personnel mobilising to work on the onshore pipelines will complete inductions as described in Section 8.6.1. The DCGP inductions include the maximum speed limits for the sites and access roads which are public access:

- Forty Mile Beach Road: 60 km/h
- Sealed North West Coastal Highway: 110 km/h or as signposted.

The onshore operational area transects coastal areas of sandy beach and mangroves. These areas are where the pipeline is below ground. Inspection of the pipeline in this area is conducted remotely from within the pipeline. Vehicles will not be used to inspect this area; therefore, impact to mangroves, nesting sea turtles and other fauna within this area will not occur. Some intermittent access may be required to ensure safety signage is adequate to ensure the safety of public accessing this area. Staff are trained in fauna sighting procedures and how to ensure their own and the fauna's safety during activities.

7.5.2.2 Entrapment of fauna in open excavations

Fauna (reptiles) may also become entrapped in excavations such as pits if pipeline maintenance activities are required. Fauna entrapment may lead to injury or death to fauna through starvation, dehydration or drowning.

Fauna entrapment in excavations such as pits and bores is a very rare occurrence. At DCGP for example, none of these incidents have been recorded in the past 10 years of plant operations. Therefore, there are no activities that are considered high risk for fauna entrapment, and entrapment does not represent a significant threat to terrestrial fauna populations (birds or reptiles) on the mainland.

As the majority of excavation work occurs within previously disturbed areas and all are restricted to the lease area, there are no potential activities that are considered to present a high risk to fauna or their habitat in the vicinity of the pipelines and DCGP.

7.5.2.3 Introduction and or spread of weeds (Non-indigenous species)

Vehicles traversing through areas have the potential to carry the seeds of weed species. Introduction and spread of non-indigenous plant species may change the diversity of native vegetation communities through competition for resources. Changes include alteration of the community structure and species composition and abundance of a community.

Spread of weed species may occur naturally due to wind and natural processes, or anthropogenically introduced such as seeds within soil collected on earthmoving machinery, equipment or materials transport, and from movement of vegetation during weed management activities. However, given that excavations within the pipeline corridor are

infrequent, and vehicle movement is minimal, the risk associated with the spread of weeds is negligible for the activities described in this EP.

Given that the adjacent lands are cattle properties and public road access, there is currently a significant weed proliferation (buffel grass (*Cenchrus ciliaris*)) dominant within the onshore section of the DC supply pipeline rehabilitation corridor. However, the distribution and abundance are consistent with the existing proliferation of the species prior to project commencement (AES, 2013). The activities associated with the pipeline inspections will not increase the risk of weed proliferation from that of normal activities in the area.

7.5.2.4 Erosion

The pipeline corridor presents a low risk of erosion from pipeline inspection activities as the corridor is set within flat terrain, is well stabilised with surrounding vegetation, and the soils are well drained. Driving on the rehabilitated sections of the pipeline corridor could damage slow-growing rehabilitated vegetation, acid sulphate soils may also become exposed. However, the likelihood is significantly reduced because:

- Forty Mile Beach Road (public road access) runs directly adjacent to the pipeline corridor and is used for site vehicles when personnel access the inspection sites
- A vehicle operating on the pipeline corridor introduces risk associated with non-controlled activities operating above a high-pressure gas line.

7.5.2.5 Operation of drones

Activities relevant to the operational area will relate to onshore pipeline corridor inspections. Inspections may be conducted intermittently to inspect the integrity of the pipeline and signage (Section 2.4). Due to the intermittent nature and short timeframes of these inspections, no significant impact to species is expected. Any drone use for the project will be conducted lawfully in compliance with applicable State and Federal legislation and licensing requirements, including adherence to separation distances. Equipment and vehicles are maintained to ensure optimum operating conditions, which in turn reduces risk to personnel and the environment. Collision with terrestrial fauna as a result of drone operation is highly unlikely. Drone collision is covered in Section 7.2.3 control measures for interaction with marine fauna.

7.5.2.6 Fires

Fire as a result of Santos operational activities within the DC pipeline operational area is credible but very unlikely due to the probability of release from the DC pipeline. To assess the nature and scale of an accidental fire, it needs to be recognised that a release would also require a source of ignition. Given the pipeline is buried, ignition sources surrounding the pipeline are limited and related to third parties travelling along the main roads or natural occurrences such as lighting strikes and extreme heat.

Receptors: Physical environment (terrestrial vegetation), threatened/migratory fauna (terrestrial fauna)

Physical Environment:

Vegetation within the onshore operational area includes two communities that are on the WA list of priority ecological communities the pipeline corridor intercepts (crosses through) a very small portion of both of these PECs (Refer Section 3.2.4) meaning that it is unlikely a fire would affect the whole of the PECs.

In terms of potential impact to valuable/sensitive fauna, the vegetation/physical habitat in the area is considered low quality (Refer Appendix C) consisting of low lying sparsely vegetated scrub. The OEPA undertook an on-site audit in October 2013. It was noted during the audit that there are external pressures impacting on the pipeline easement rehabilitation. These included damage caused by public vehicle access, road maintenance activities and cattle, which are not a result of Santos' management or operational activities and are beyond Santos' control. On this basis it is considered that the vegetation within the operational area is low quality.

With respect to the potential recovery of habitat, native flora is known to adapt to, and recover from fire events. Many plant species lie hidden in the soil as propagules - rather than being apparent as mature plants and as a result of a fire these species are able to germinate and appear above ground. It is recognized that fires may promote or adversely affect biodiversity. In the unlikely event that impacts did occur, it would be highly probable that only a small area of the physical environment within the region and within the PEC might be affected. Recovery from any impacts to native vegetation are expected to be relatively short-term (months).

Threatened/migratory fauna

Fire results in injury or death of fauna and destruction of vegetation and habitat in areas of fire. Whilst short-term behavioural impacts may also be expected if habitat is destroyed and may lead to a disruption in breeding and foraging activities, impacts at a population level are not expected because the pipeline corridor is an open environment which can allow for able fauna to move away.

Avoidance of habitat may arise if toxic fumes, smoke and soot associated with the fire are present. This may also result in potential eye and respiratory system irritation but is expected to be short term and abate with time.

While the potential exists for impacts to occur from an accidental fire, fauna population level impacts are not expected. In the unlikely event that impacts did occur, it would be highly probable that only individuals would be affected.

7.5.3 Environmental performance objectives and control measures

The EPO relating to this hazard is:

- No injury or mortality to EPBC Act and WA *Biodiversity Conservation Act 2016* listed fauna during activities [EPO-DC-01]
- No fire as a result of activities within the DC pipelines operational area [EPO-DC-10].

The control measures considered for this event are shown in Table 7-6, with EPSs and measurement criteria for the EPO described in Table 8-2.

Table 7-6: Disturbance to terrestrial fauna – Control measures evaluation

Ref. No	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-02	Project execution plan for management of excavation activities	Engineering	The provision of fauna escape or exclusion means for excavations reduces the risk of fauna entrapment and injury or death.	Cost (time and materials) associated with provision of fauna escape or exclusions.	**Adopted** – Environmental benefit of reducing impacts outweighs the costs. The provision of fauna escape or exclusion means for excavations is considered a standard industry control.
DC-CM-54	Terrestrial fauna sightings in the operational area are recorded during operations and IMMR activities if they have potential to interact with personnel or activities.	Administrative	Reduces the risk of interaction with terrestrial fauna as a result of operations or IMMR activities.	Cost associated with maintaining fauna sighting register.	**Adopted** – Benefits in reducing impacts to marine fauna outweigh the costs incurred by Santos.
DC-DM-38	Permit to Work System.	Administrative	Ensure appropriate controls for hot work are in place to manage potential environmental impact from accidental fire.	Operational and labour costs to maintain the PTW system.	**Adopted** – environmental benefit outweighs cost.
DC-CM-39	Emergency response plan detailing the requirements for preparedness and response to emergencies and crises to protect people	Administrative	Reduce potential escalation of fire.	Costs for equipment and training.	**Adopted** – environmental benefit outweighs cost.

Ref. No	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
	and the environment.				
DC-CM-40	Engineering change management procedure	Administrative	The engineering change management procedure ensures that any changes or new information/ hazards are identified and appropriately managed.	Costs associated with personnel time in assessing changes/ information and updating hazard registers/risk assessments.	**Adopted** – environmental benefit outweighs cost.
Additional Controls					
N/A	Elimination of vehicle use for pipeline inspections and maintenance.	Elimination	Eliminates the risk for fauna collisions and ignition risk for fire.	Carrying out inspections on foot is an increased risk to health and safety of individuals. Inspection and maintenance activities are designed for the optimal performance of the pipeline.	**Rejected** – Increased risk to personnel is too high when compared to low risk to terrestrial fauna.

7.5.4 Environmental impact assessment

Terrestrial Flora and Fauna Interaction – Excavation, vegetation clearing and vehicle collision	
Receptors	Terrestrial fauna and flora
Pre-treatment consequence	
	III – Moderate for fire, excavation, vegetation clearing and vehicle collision
Consequence	
	III – Moderate for fire, excavation, vegetation clearing and vehicle collision
Fauna collision, excavation and vegetation clearing could result in injury or mortality to individuals but is not expected to impact populations given the vast length of the DC pipeline corridor and the open spatial environment in which it is located. No significant impact to local population size is expected as an objective of this risk. The potential impacts are limited to individuals and therefore assessed as moderate. Fire is a natural event in the Pilbara that often occurs as a result of lightning strike, which native flora and fauna has adapted to, and recovery occurs within 1 month to 1 year The consequence is considered Moderate as EPBC Act and WA Biodiversity Conservation Act 2016 listed fauna may be impacted in the event of a fire and it could affect a widespread area.	
Likelihood	C – Possible for excavation, vegetation clearing and vehicle collision
	B – Unlikely for fire
It is considered possible that vehicles will collide with marine fauna given they are frequently found on the road and moving slowly. Although vehicle use within the operational area is limited to daylight activities where fauna sighting will be easiest, and vehicle speeds are extremely slow collisions could be possible. Excavation may lead to fauna entrapment and potential injury which would be a moderate disturbance to fauna rather than death to multiple individuals. An accidental fire is considered very unlikely due to the probability of release and ignition.	
Residual Risk	The residual risk associated with fire, excavation, vegetation clearing and vehicle collision is Low.

7.5.5 Demonstration of ALARP

Routine pipeline inspection activities are only to be undertaken during the day and in accordance with the site's speed limits. This reduces the potential for interaction with nocturnal fauna. Whilst the elimination of inspections would

remove the potential for adverse interactions with terrestrial fauna or areas of flora at any time, it would potentially increase risk and compromise the safe operation of the pipeline.

Prevention against fire is minimised as far as practicable through inherent safety (safety in design) such as,

- Buried pipeline, reducing risk of damage
- Minimising leak sources (through consideration of the number of flanges, joints)
- Robust design of all pressure containing equipment
- Corrosion control and monitoring
- Safety Instrument Systems (SIS) and process control Systems PCS reducing probability of overpressure event.

And ongoing maintenance such as:

- Planned maintenance uses pigging rather than above ground activities
- Robust maintenance program (refer Section 2.3)
- Minimising probability of ignition.

If personnel are required to drive out to areas along the pipeline, vehicles would typically be used on Forty Mile Beach Road, or existing cleared tracks, rather than over native vegetation where there is possibility of the vehicles sparking a fire.

Should any unforeseen maintenance activities require other activities that may increase the risk of fire, these would be assessed separately and if required an update to this EP would be prepared (e.g. written notification or bridging document).

On balance, it is considered that interactions with terrestrial fauna and flora have been reduced to ALARP with the inherent safety in design measures used during construction, and the proposed control measures in place for operation and maintenance of the DC supply pipeline.

7.5.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – Disturbance to terrestrial flora and fauna residual risk is ranked Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian Marine Park zoning objectives)?	Yes – Consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice.
Are performance standards consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are performance standards consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

. The residual risk associated with fire, excavation, vegetation clearing, and vehicle collision is low.Therefore the worst case Residual risk is ranked Low due to the potential interaction with EPBC Act and WA Biodiversity and Conservation Act listed species While the potential exists for impacts to occur from an accidental fire, population level impacts are not expected. In the unlikely event that impacts did occur, it would be highly probable that only individuals or small areas of habitat would be affected. Recovery from any impacts to native vegetation are expected to be relatively short-term (months).

Given the infrequent access to the operational area, the very unlikely probability of fire, daylight inspections, and the increased risk if inspections are not carried out, Santos considers this risk acceptable.

7.6 Overview of unplanned release of hydrocarbons

7.6.1 Credible spill scenarios

A number of unplanned events may occur during the operation of the DC pipelines infrastructure and associated activities, resulting in the potential release of hydrocarbons (condensate and diesel) to the marine environment. The spill scenarios assessed in Sections 7.6 to 7.9 include a description of the variations in the type of hydrocarbon released (i.e. condensate or diesel) and the potential point of release (i.e. sea surface release versus subsea) at a range of locations within the operational area. The credible spill scenarios are summarised in Section 7.6.2 and Table 7-7.

Spill modelling was undertaken for the scenarios presented in Table 7-7 by RPS during 2024.

7.6.2 Spill scenario selection

It is considered credible that an unplanned release of condensate and gas could occur from the subsea DC supply pipeline. Loss of containment caused by a dropped object, anchor drag or loss of pipeline integrity is deemed a credible scenario under the assumption of multiple and simultaneous failures of the controls in place. A loss of containment would escalate to a loss that would be detected and result in an almost instantaneous emergency shutdown (ESD). The maximum credible spill was determined as being a complete loss of the volume of condensate in the pipeline (largest hydrocarbon storage capacity of 121.4 m^3), due to an automatic detection of the leak, and the safety valves at the Reindeer WHP end (Commonwealth waters) and the DCGP end of the pipeline being automatically closed. A subsea release of condensate from the DC supply pipeline at the Commonwealth and State water boundary and near the HDD crossing is considered in Section 7.7.

It is considered credible that a release of diesel to the marine environment could occur from a support vessel or due to collision with another vessel in the operational area. Such a collision could have sufficient impact to result in rupture of a vessel's diesel tank. This is considered credible, given that the diesel tanks may not be protected or double-hulled and fuel tank ruptures leading to hydrocarbon release have occurred before. It is possible that a dropped object during a bunkering process could damage the hull of a support vessel, leading to a release of diesel from a tank. The maximum credible spill volume from a vessel incident is 325 m3, based on the largest single fuel tank capacity. This scenario would result in a spill of diesel at the sea surface.

A vessel collision scenario is the maximum credible diesel spill scenario from a vessel fuel tank and has been modelled at the Commonwealth-State waters boundary and the HDD crossing. A surface release of vessel tank diesel at the HDD crossing represents the worst-case spill of the two scenarios and is discussed in Section 7.8. The assessed credible spill scenarios are summarised in Table 7-7.

Another credible spill scenario identified is a release during vessel bunkering (fuel hose failure or rupture, coupling failure, or tank overfilling) where fuel bunkering would need to be stopped manually. Fuel released prior to the cessation of pumping, as well as fuel remaining in the transfer line, may escape to the environment. The Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities (AMSA, 2015) provides guidance for calculating a maximum credible spill volume for a refuelling spill. The maximum credible spill volume during refuelling is calculated as: transfer rate (60 m^3/hr) × 15 minutes of flow, resulting in a potential 15 m^3 spill volume at the sea surface. The detection time of 15 minutes is seen as conservative but applicable following failure of multiple barriers followed by manual detection and isolation of the fuel supply.

Santos has considered that a pipeline rupture may be a credible spill scenario onshore and would result in an approximately 15-hour leak of 121.4 m^3 of Reindeer condensate from the buried DC supply pipeline. It is noted that the pipeline is buried within the operational area for this EP, and the pipeline is above ground within the DCGP but the DCGP is outside the scope of this EP.

The maximum credible spill scenarios presented were based on the below TFNs which were revised for CoP activities in 2024:

- Devil Creek Gas Supply Pipeline - Pipeline Rupture TFN (7745-650-REP-0029), January 2024
- Reindeer Platform - Vessel Collision: MDO/MGO Surface Release TFN (7745-650-REP-0031), January 2024

Table 7-7: Summary of maximum credible spill scenarios

Max. Credible Spill Scenario	Hydrocarbon Type	Max. Credible Volume	Comment	EP Section
Scenario 2 Subsea release: Hydrocarbon spill from a loss of pipeline containment	Gas/ Condensate	121.4 m^3	Leaking or ruptured pipeline leak of 121.4 m^3 of Reindeer condensate over 3.71 hours near the State/Commonwealth waters boundary (CSB)	7.7
Scenario 3 Subsea release: Hydrocarbon spill from a loss of pipeline containment	Gas/ Condensate	121.4 m^3	Leaking or ruptured pipeline leak of 121.4 m^3 of Reindeer condensate over 3.75 hours near the horizontal directional drilling (HDD) break through location (or shoreline crossing)	7.7
Scenario 5 Surface release: Hydrocarbon spill from vessel collision,	MDO	325 m^3	Maximum credible volume based on predicted largest fuel tank on support vessel over one hour following a vessel collision at the CSB.	7.8
Scenario 6 Surface release: Hydrocarbon spill from vessel collision,	MDO	325 m^3	Maximum credible volume based on predicted largest fuel tank on support vessel over one hour following a vessel collision at the HDD crossing	7.8
Scenario 7 Land-based spill: Release from supply gas onshore pipeline due to a major rupture[5]	Gas/ Condensate	121.4 m^3	Leaking or ruptured pipeline (0–24-hour leak of 121.4 m^3 of Reindeer condensate onshore)	7.9

Note: Scenarios 1 and 4 are locations in Commonwealth waters and are therefore not described in this EP.

7.6.3 Spill modelling overview

To determine the spatial extent of impacts from a potential hydrocarbon spills from the DC supply pipelines and associated activities modelling was completed by RPS (RPS, 2024).

Stochastic spill modelling was performed using a number of simulated environmental conditions from winter, summer and transitionary seasons. The stochastic model was run for a total of 300 simulations, 100 for each of the three seasons (winter, summer and transitionary). The 'spill time' for each simulation as randomly varied therefore varying meteorological and oceanographical characteristics applied to the spill. The outputs of this modelling showed a number of different possible spill outcomes of a spill which were then analysed to determine the concentrations of hydrocarbon at each grid cell of the model providing information about the probability of contact and concentration at contact of hydrocarbons across the whole EMBA. The tidal modal domain has been sub-gridded to a resolution of 500 m for shallow and coastal regions, starting from an offshore (Deep water) resolution of 8 km. The finer grids were allocated in a step-wise fashion to resolve flows more accurately along the coastline, around islands and over regions with more complex bathymetry

Deterministic modelling was also performed to inform operational and scientific monitoring from a single spill event. The deterministic model took a single run selected from the stochastic analysis that represented a single trajectory of a hydrocarbon spill – this is discussed further in the OPEP.

The outcomes of this modelling are described in Section 7.7 and 7.8.

7.6.4 Hydrocarbon characteristics

Table 7-8 provides a summary of characteristics of hydrocarbons relevant to the credible spill scenarios identified for the activity.

It's noteworthy that the heavier components for the condensate and MDO, specifically the low volatile and persistent portions, will have a strong tendency to become entrained into the water column in the presence of moderate winds (above 10 knots) and in turn breaking waves, however, it can resurface under calm conditions (less than 10 knots).

[5] *A rupture of the onshore buried pipeline is of low credibility due to its buried position. A slow leak is a more likely release mechanism. A maximum credible slow leak volume was calculated as 205 m^3. Given this is on a similar scale to a rupture volume, the rupture volume has been used for conservatism and consistency with the offshore pipeline section.*

Table 7-8: Characteristics of hydrocarbons (RPS, 2024)

Hydrocarbon	Hydrocarbon Classification (AMSA, 2015)	Initial density (kg/m^3)	Viscosity (cP) @ 25oC	Component	Volatiles	Semi-volatiles	Low volatility	Residual
				Boiling Point (°C)	<180 C4-C10	180–265 C11-C15	265–380 C16-C20	>380 >C20
					Non-Persistent			Persistent
Reindeer Condensate 2023[3]	Group I	784.2 @ 15 °C	0.683 @ 20 °C		74	17	8	1
Diesel	Group II	890 @15 °C	14 @ 25 °C		4	32	54	10

7.6.4.1 Reindeer condensate

Table 7-8 details the properties of Reindeer Condensate taken from a 2023 Assay Report, as used to inform oil spill modelling presented in the EP. Reindeer condensate (Intertek, 2023) has an API of 48.9, a density of 784.2 kg/m^3 (at 15 °C) and a low viscosity value of 0.683 cP (at 20 °C). Due to its low viscosity, if spilt on the sea surface, the condensate would rapidly spread and thin out.

Based on its boiling point distributions, approximately 74% of the product, which are the volatile components, is expected to evaporate within the first 12 hours (Boiling point (BP) < 180 °C); a further 17%, the semi-volatiles, should evaporate within the first 24 hours (180 °C < BP < 265 °C); and the low volatile portion (8%) should evaporate over a longer period (265 °C < BP < 380 °C). It is then expected that the remaining 1 % shall persist in the marine environment for much longer periods and would be subject to relatively slow degradation. It is categorised as a group I non-persistent oil according to the AMSA (2023) classifications.

The condensate has a low asphaltene content (<0.5%), indicating a very low propensity to take up water to form water-in-oil emulsion.

7.6.4.2 Marine diesel

The MDO has a density of 890.0 kg/m^3 at 15ºC (API of 27.5) and a low pour point of −9.0 °C. The low viscosity (14.0 cP at 25 °C) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation (Figure 7-4).

Generally, about 4% of the MDO mass should evaporate within the first 12 hours (BP < 180 °C); a further 32% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and an additional 54% should evaporate over several days (265 °C < BP < 380 °C). Approximately 10% (by mass) of MDO will not evaporate, though will decay slowly over time.

7.6.5 Hydrocarbon exposure values

To inform the impact assessment it is important to understand the concentrations of hydrocarbons within the EMBA 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 described below.

The EMBA shown in Figure 3-1 was identified using low exposure values for all four scenarios that have been modelled. 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).

To inform impact assessment, exposure values that may be representative of biological impact have also been identified. These are called “moderate exposure values” and “high exposure values”. Moderate and high exposure values are modelled for each fate of hydrocarbon to identify what contact is predicted for surface (floating oil), subsurface (entrained oil and dissolved aromatic hydrocarbons), and shoreline accumulation of hydrocarbon at sensitivities.

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 identify appropriate exposure values Santos have considered the advice provided by NOPSEMA Bulletin #1 Oil Spill Modelling (April, 2019) and scientific literature. The selected hydrocarbon exposure values are discussed in Table 7-9, Table 7-10, Table 7-11 and Table 7-12, 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).

Table 7-9: Floating hydrocarbons exposure values

Surface Oil Concentration (g/m^2)	Exposure Value	Description
1	Low	***Risk Evaluation*** It is recognised that a lower floating 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 socio-economic receptors and has been used as the exposure value to define the spatial extent of the environment that might be contacted (EMBA) from floating oil. ***Response Planning*** Contact at 1 g/m^2 (as predicted by oil spill trajectory modelling) is used as a conservative trigger for activating scientific monitoring plans as detailed in the OPEP.
10	Moderate	***Risk Evaluation*** There is a paucity of data on floating oil concentrations with respect to impacts to marine organisms. Hydrocarbon concentrations for registering biological impacts resulting from contact of surface slicks have been estimated by different researchers at about 10–25 g/m^2 (French et al., 1999; Koops et al., 2004; NOAA, 1996). The impact of floating oil on birds is better understood than on other receptors. A conservative threshold of 10 g/m^2 has been applied to impacts from surface hydrocarbons (floating oil) in this EP. Although based on birds, this hydrocarbon threshold is also considered appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1997). ***Response Planning*** Contact at 10 g/m^2 is not specifically used for spill response planning.
50	High	***Risk Evaluation*** At greater thicknesses the potential for impact of surface oil to wildlife increases. All other things being equal, contact to wildlife by surface oil at 50 g/m^2 is expected to result in a greater impact. ***Response Planning*** Containment and recovery effectiveness drop significantly with reduced oil thickness (McKinney et al., 2017; NOAA 2014). McKinney et al. (2017) tested the effectiveness of various oil skimmers at various oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was less than 50 g/m^2 (less than Bonn Agreement Code 4). Hence, 50 g/m^2 has been set as a guide for planning effective containment and recovery operations. Similarly, surface oil >50 g/m^2 (Bonn Agreement Code 4/5 and equivalent to oil observed as discontinuous or continuous true colour) is considered to be a lower limit for effective dispersant operations and is therefore considered for planning.

Table 7-10: Shoreline hydrocarbon accumulation exposure values

Shoreline Accumulation (g/m^2)	Exposure Value	Description
10	Low	***Risk Evaluation*** An accumulated concentration of oil above 10 g/m^2 on shorelines is considered to represent a level of socio-economic effect (NOPSEMA, 2019); e.g. 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). ***Response Planning*** Not specifically used for response planning because below the limit that can be effectively cleaned.
100	Moderate	***Risk Evaluation*** The impact threshold concentration for exposure to hydrocarbons stranded on shorelines is derived from levels likely to cause adverse impacts to marine or coastal fauna and habitats. These habitats and marine fauna known to use shorelines are most at risk of exposure to shoreline accumulations of oil, due to smothering of intertidal habitats (such as mangroves and emergent coral reefs) and coating of marine fauna. Environmental risk assessment studies (French-McCay, 2009) report that an oil thickness of 0.1 mm (100 g/m^2) on

Shoreline Accumulation (g/m^2)	Exposure Value	Description
		shorelines is assumed as the lethal threshold for invertebrates on hard substrates (rocky, artificial or man-made) and sediments (mud, silt, sand or gravel) in intertidal habitats. Therefore, a conservative exposure value for impacts of 100 g/m^2 has been applied to impacts from shoreline accumulation of hydrocarbons. ***Response Planning*** A shoreline concentration of 100 g/m^2, or above, is likely to be representative of the minimum limit that the oil can be effectively cleaned according (AMSA, 2015; NOPSEMA, 2019) and is therefore used as a guide for shoreline clean-up planning. This threshold equates to approximately ½ a cup of oil per square meter of shoreline contacted.
1,000	**High**	***Risk Evaluation*** At greater thicknesses the potential for impact of accumulated oil to shoreline receptors increases. All other things being equal, accumulation of oil above 1000 g/m^2 is expected to result in a greater impact. ***Response Planning*** As oil increases in thickness the effectiveness of oil recovery techniques increases. This value can therefore be used to prioritise oil recovery efforts, assuming oil recovery is deemed to have an environmental benefit.

Table 7-11: Dissolved aromatic hydrocarbon exposure values

Dissolved hydrocarbons (ppb)	Exposure Value	Description
10	**Low**	***Risk Evaluation*** Dissolved Aromatic Hydrocarbons include the monoaromatic hydrocarbons (MAHs) (compounds with a single benzene ring such as BTEX [benzene, toluene, ethyl benzene, and xylenes]) and polycyclic aromatic hydrocarbons (PAHs) (compounds with multiple benzene rings such as naphthalenes and phenanthrenes). These compounds have a greater bioavailability that other components of oil and are considered to be main contributors to oil toxicity. The toxicity of DAHs is a function of the concentration and the duration of exposure by sensitive receptors with greater concentration and exposure time causing more sever impacts. Typically tests of toxicity done under laboratory conditions measure toxicity as proportion of test organisms affected (e.g. 50% mortality or LC50) at the end of a set time period, often 48 or 96 hours. French-McCay (2002) in a review of literature, reported LC50 for dissolved PAHs with 96 h exposure, range between 30 ppb for sensitive species (2.5th-percentile species) and 2,260 ppb for insensitive species (97.5th-percentile species), with an average of about 250 ppb. The range of LC50s for PAHs obtained under turbulent conditions (this includes fine oil droplets) was 6–410 ppb with an average of 50 ppb (French-McCay, 2002). More recently, French-McKay (2018) described in-water thresholds as 10–100 µg/L (equivalent to ppb). Regarding the effect of UV on PAH toxicity, French-McKay et al (2018) uses the findings of DWH NRDA Trustees (2016) to adjust for this affect by reducing the water column exposure thresholds by 10x in the top 20 m of the water column. The dissolved hydrocarbon 10 ppb exposure value has been used to inform the EMBA within Sections 7.7 and 7.8. An exposure value of 10 ppb is appropriate as it is concentration that could have some potential negative effect on marine organisms. ***Response Planning*** Contact at 10 ppb (as predicted by oil spill trajectory modelling) is used as a trigger for activating scientific monitoring plans as detailed in the OPEP. Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers (NOPSEMA, 2019).
50	**Moderate**	***Risk Evaluation*** Approximates potential toxic effects, particularly sublethal effects to sensitive species (refer to above text). Consistent with NOPSEMA (2019). For most marine organisms, a concentration of between 50 and 400 ppb is considered to be more appropriate for risk evaluation. ***Response Planning*** Encompassed by response to 10 ppb. There is no different response planning for higher exposure values.

Dissolved hydrocarbons (ppb)	Exposure Value	Description
400	High	***Risk Evaluation*** Approximates toxic effects including lethal effects to sensitive species (NOPSEMA, 2019). ***Response Planning*** Encompassed by response to 10 ppb. There is no different response planning for higher exposure values

Table 7-12: Entrained hydrocarbon exposure values

Entrained hydrocarbons (ppb)	Exposure Value	Description
1000	Low / Moderate	***Risk Evaluation*** Entrained hydrocarbons, as opposed to dissolved aromatic hydrocarbons (DAHs), are oil droplets suspended in the water column. Factors including bioavailability of constituents in the oil, changing composition of the oil as it weathers, and likelihood and duration of exposure all contribute to the dynamic nature of entrained and dissolved oil aquatic toxicity at any given time in an oil spill scenario. In relatively fresh oil, some of the hydrocarbons in entrained oil droplets are soluble/semi-soluble that may later dissolve and become bioavailable. Polycyclic aromatic hydrocarbons (PAHs) and related compounds present in fresh oil are the most toxic components (as described in Table 7-10). However, entrained oil droplets weather rapidly because of their high surface area relative to their volume. As oil weathers, the potentially toxic components diminish (via volatisation, dissolution and biodegradation) to the point where entrained droplets are effectively non-toxic (French-McCay et al., 2023; Parkerton et al., 2023). Therefore, effects levels for the bioavailable, soluble and semi-soluble components should not be applied to whole oil entrained droplets, particularly for weathered entrained oil droplets. Entrained hydrocarbons still have potential effects on marine organisms through direct contact with exposed tissues and ingestion (NRC 2005). However, research has not definitively demonstrated direct effects of whole-oil droplets as separable from the effects of toxic components dissolved from the oil (Parkerton et al., 2023), and the level of exposure causing effects is considered to be significantly higher than for DAHs (NASEM 2020; French-McCay 2016, 2024). A review by French-McCay (2024) on considerations for the development of entrained oil thresholds for oil spill risk assessments, recommends entrained thresholds based on total hydrocarbon content (THC) and related compounds. However, given the variable composition of entrained oil as it weathers, the development of effects levels or thresholds based on THC is acknowledged to be problematic (French-McCay 2024). Crude oils typically contain about 1% PAHs by mass (French-McCay 2002; Forth et al., 2017), therefore the sublethal concentration threshold (predicted no-effect concentration [PNEC]) expressed as THC based on the most toxic components would be ~100 ppb (100 µg/L) for fresh oil (French-McCay 2016). However, as oil weathers, PAHs are lost to volatisation, dissolution and biodegradation, thus making application of this threshold to entrained oil droplets overly conservative (as described above). In addition, exposure durations in the sea are brief, order of minutes to hours, not days or longer as used in most bioassay studies (Bejarano et al., 2017). Effects levels are orders of magnitude higher for exposure durations of less than 24 hours (French-McCay 2002). Given these considerations, French-McCay (2024) suggests 1,000 ppb to be sufficiently conservative for entrained oil droplets of all oil types and all weathering states. This is supported by a number of toxicity studies including a review by Bejarano et al., (2017), which identified THC lethal effects levels of 3–28 mg/L (3,000–28,000 ppb) for a range of oils and states of weathering for aquatic species from all geographical areas globally. An exposure concentration of 1,000 ppb of measurable Total Petroleum Hydrocarbon (TPH) was deemed a low level of concern for sensitive life stages in marine organisms by Kraly et al. (2001). In reviews by NRC (2005) and NASEM (2020), 1,000 ppb was similarly found to be at the low end of the range where sub-lethal impacts from acute exposure have been observed. Correcting for the fact that TPH measurements are on a portion of the oil and not the full oil (i.e. THC), this indicates a threshold of 3,000 ppb would be appropriate for modelled entrained oil. Thus, French-McCay (2024) concludes that a THC threshold of 3,000 ppb is an appropriate threshold for crude oils and 1,000 ppb for light distillates and condensates for use in risk assessments and for use in defining an EMBA with other oil phases.

Entrained hydrocarbons (ppb)	Exposure Value	Description
		Santos has therefore adopted the use of a low/moderate entrained oil threshold of 1,000 ppb for use in risk assessments and for defining an EMBA and MEVA to ensure conservatism.

7.6.6 Spill risk assessment approach

A consistent risk assessment approach is applied to each unplanned hydrocarbon release scenario in Sections 7.7 and 7.8. The spill risk assessment approach adopted is based on Santos' Oil Spill Risk Assessment and Response Planning Procedure (QE-91-II-20003). The procedure describes the spill risk assessment process as follows:

1. Identify the spatial extent of the environment that may be affected (the EMBA). This has been completed for this EP as part of the assessment of the existing environment and receptors that are known to occur, or may occur within the EMBA, are described in Section 3 and Appendix C
2. Identify areas of high environmental value (HEV) within the EMBA (HEVs are defined in Section 7.6.6.2)
3. Identify and then risk assess hotspots. Hotspots are effectively a subset of HEVs and their determination is described in Section 7.6.6.3
4. Identifies priorities for protection (for consideration of spill response strategies in the OPEP).

The spatial extent and potential for impacts is driven by the two diesel spill scenarios and the pipeline rupture scenario. Therefore, a hotspot consequence workshop was completed on 21 May 2024 for all the spill scenarios selected. This provides a detailed assessment of the worst-case impacts from an accidental oil spill associated with the activity.

7.6.6.1 Spill EMBA

Defining the EMBA by an oil spill is the first step in oil spill risk assessment. For activities where there is the potential for multiple spill scenarios, the spill scenario, or combination of spill scenarios, resulting in the greatest spatial extent of impacts is used to define the overall EMBA for the activity. The EMBA is further described in Section 3.1.

7.6.6.2 Areas of high environmental value

Santos has predetermined areas of HEV (Figure 7-1) along the Western Australian coastline by ranking these areas based on:

- Protected area status – This is used as an indicator of the biodiversity values contained within that area, where a World Heritage Area, Ramsar Wetland and Marine Protected Area will score higher than areas with no protection assigned
- BIAs of listed threatened species – These are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour, such as breeding, feeding, resting or migration. Each one of these within the predefined areas contributes to the score.

Further input to determine areas of HEV included:

- Sensitivity of habitats to impact from hydrocarbons in accordance with the guidance document Sensitivity Mapping for Oil Spill Response produced by IPIECA, the International Maritime Organisation and International Association of Oil and Gas Producers
- Sensitivities of receptors with respect to hydrocarbon-impact pathways
- Status of zones within protected areas (i.e. IUCN (1a) and sanctuary zones compared to IUCN (VI) and multiple use zones)
- Listed species status and predominant habitat (surface versus subsurface)
- Social values, i.e. socio-economic and heritage features (e.g. commercial fishing, recreational fishing, amenities, aquaculture).

Tallied scores for each predefined area along the Western Australian coastline were then ranked from 1 to 5, with an assignment of 1 representing areas of the highest environmental value and those with 5 representing the areas of the lowest environmental value.

7.6.6.3 Hot spots

While the entire EMBA will be considered during risk assessment and spill response planning, it is best practice to concentrate greatest effort and level of detail on those parts of the EMBA that have:

- The greatest intrinsic environmental value – i.e. HEV areas ranked 1–3
- The highest probability of contact by oil (either floating, entrained or dissolved aromatic)
- The greatest potential concentration or volume of oil arriving at the area.

These areas are termed 'Hot Spots'. Defining Hot Spots is typically the first step in undertaking detailed spill risk assessment and spill response planning. Hot Spots are a subset of HEV areas that:

- Have the highest probability of contact (at least higher than 5%) above the impact assessment thresholds for surface hydrocarbons and shoreline accumulation based on modelling results
- Receive the greatest concentration or volume of oil, either floating or stranded oil, entrained oil or dissolved aromatic hydrocarbons above contact thresholds described in Section 7.6.5.
- Additional areas may be selected as Hotspots for detailed risk assessment, for example if stakeholder consultation has identified areas of particular concern that are not already included in the risk assessment. Additional discretionary hotspots may also be included where they do not strictly meet all of the criteria of a hotspot e.g. a HEV ranked 1–3 with <5% probability, or a HEV ranked 4 or 5 with >5% probability, depending on the concentrations and volumes of hydrocarbons presented in the modelling report. When a discretionary hotspot is added it will be identified as 'discretionary' and the rationale for its inclusion as a hotspot will be described.

7.6.6.4 Priorities for protection

For the purposes of a spill response preparedness strategy, it is not necessary for all Hot Spots to have detailed planning. For example, wholly submerged Hot Spots may only be contacted by entrained oil, and the response would be largely to implement scientific monitoring to determine impact and recovery. Hot Spots with features that are not wholly submerged (i.e. emergent features) should have specific spill response planning conducted. This final determination of 'Priority for Protection' sites, for the oil spill response strategy, is based on the worst-case estimate of floating oil concentration, shoreline loading and minimum contact time at threshold concentrations. An assessment of each protection priority will be undertaken to determine the most appropriate spill response strategies based on the type of oil and the values of the protection priority area. This can be done through a strategic NEBA approach. Identified Protection Priorities, associated key sensitivities and the applicable response strategies can be found in the OPEP.

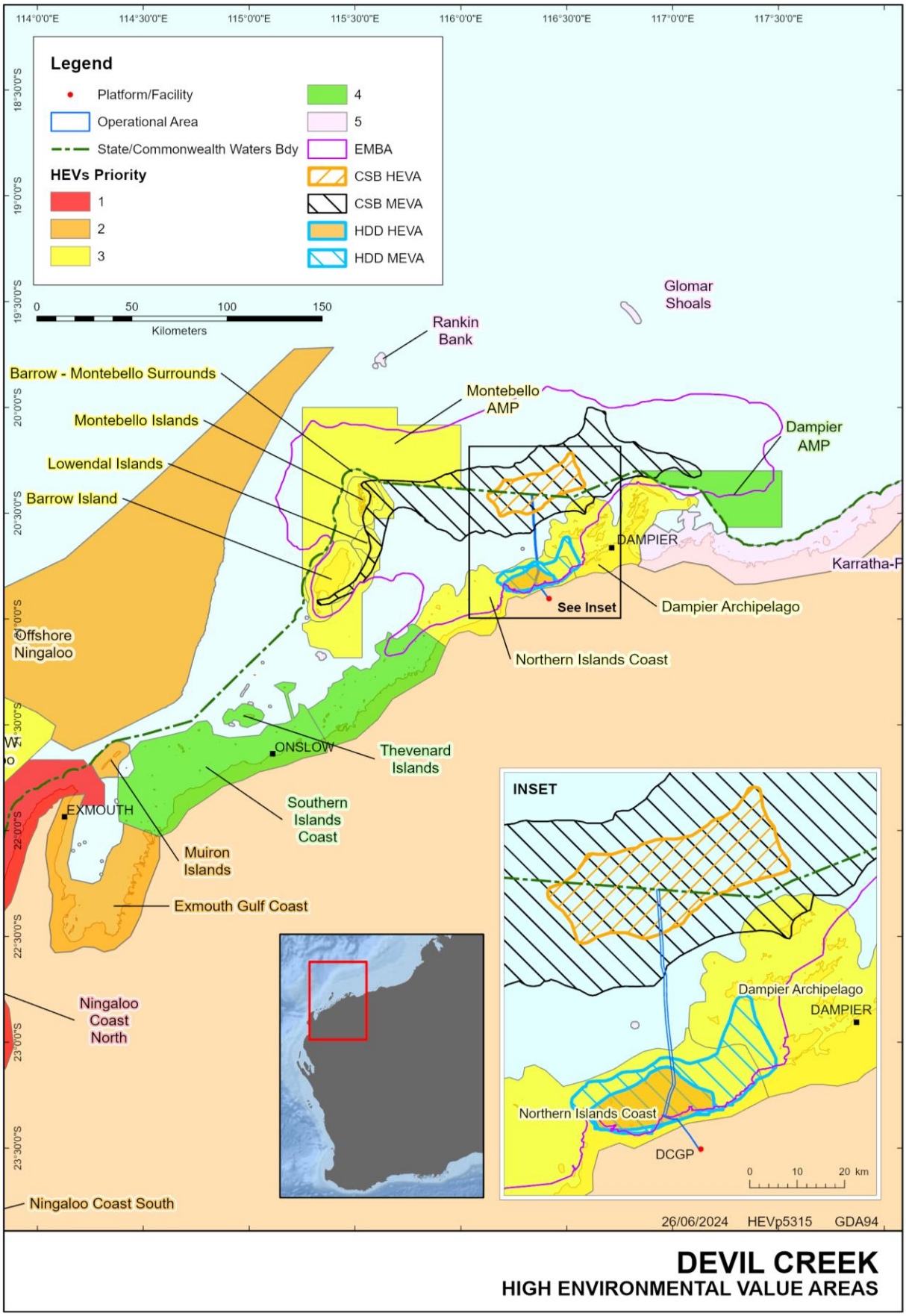


Figure 7-1: High environmental value areas within DC EMBA

7.6.6.5 Potential hydrocarbon impact pathways

To help inform the hydrocarbon spill risk assessment receptors within the EMBA and potential impact pathways have been defined (Table 7-13). The potential impact pathways consider physical and chemical pathways. Physical pathways include contact from floating oil, accumulated shoreline oil, or entrained oil droplets. Chemical pathways include ingestion, inhalation or contact from any hydrocarbon phase. These are summarised in Table 7-13 and the information is drawn upon within the hydrocarbon risk assessment for each spill scenario (Sections 7.7 and 7.8). Table 7-14 further describes the nature and scale of the hydrocarbons spills for this activity on marine fauna and socio-economic receptors found within the EMBA and moderate exposure value.

Table 7-13: Physical and chemical pathways for hydrocarbon exposure and potential impacts for receptors

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
Rocky shorelines	Shoreline loading and attachment may result in thin and sporadic coating of hydrocarbon residues. Degree of oil coating depends on the energy of the shoreline area, the type of the rock formation and continual weathering of the oil.	Impacts to flora (mangroves) and fauna further described below.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation	Impacts to flora (mangroves) and fauna further described below.
Sandy beaches	Shoreline loading and water movement may allow hydrocarbon residue to filter down into sediments, continue to biodegrade on the surface or remobilise into the surf zone. Degree of loading depends on the energy and tidal reach of the shoreline, the type of the sandy shore and continual weathering of the oil.	Indirect impacts to nesting and foraging habitats for birds and turtles. Direct impacts to infauna.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation	Indirect impacts to nesting and foraging habitats for birds and turtles. Direct impacts (mortality) to infauna through toxic effects and smothering.
Intertidal platforms	Shoreline loading and water movement may allow hydrocarbon residue to filter down into sediment, continue to biodegrade on the surface or remobilise into the surf zone. Degree of loading depends on the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the oil.	Indirect impacts to foraging habitats for birds and turtles. Direct impacts to infauna.	Chemical pathway to fauna and flora via adsorption through cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation	Indirect impacts to foraging habitats for birds. Direct impacts (mortality) to infauna through toxic effects and smothering.
Shallow sub-tidal soft sediments	Hydrocarbon residue in the shallow waters adjacent to shorelines may settle to filter down into sediments. Degree of loading is dependent upon the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the oil.	Indirect impacts to foraging habitats for turtles and fish. Direct impacts to infauna.	Adsorption via cellular membranes and soft tissue, ingestion, irritation/burning on contact and inhalation.	Indirect impacts to foraging habitats for turtles and fish. Direct impacts (mortality) to infauna through toxic effects and smothering.
Mangroves	Coating of root system may reduce air and salt exchange. Degree of coating depends on the	Yellowing of leaves. Defoliation.	External contact by oil and adsorption across cellular membranes.	Yellowing of leaves. Defoliation.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
	energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the oil.	Increased sensitivity to stressors. Tree death. Reduced growth. Reduced reproductive output. Reduced seed viability.		Increased sensitivity to stressors. Tree death. Reduced growth. Reduced reproductive output. Reduced seed viability. Growth abnormalities.
Seagrass and macroalgae	Coating of leaves or thalli may reduce light availability and gas exchange. Degree of coating depends on the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	Bleaching or blackening of leaves. Defoliation. Reduced growth.	External contact by oil and adsorption across cellular membranes.	Mortality. Bleaching or blackening of leaves. Defoliation. Disease. Reduced growth. Reduced reproductive output. Reduced seed or propagule viability.
Hard corals (coral reefs)	Coating of polyps and shading may result in reduction of light availability. Degree of coating depends on the metocean conditions, dilution, whether corals are emergent at all and continual weathering of the oil.	Bleaching. Increased mucous production. Reduced growth.	External contact by oil and adsorption across cellular membranes.	Mortality. Cell damage. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Reduced egg or larval success. Growth abnormalities.
Non- coral benthic invertebrates	Coating of adults, eggs and larvae. Degree of coating depends on the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	Mortality. Behavioural disruption. Impaired growth.	Ingestion and inhalation. External contact and adsorption across exposed skin and cellular membranes. Uptake of dissolved aromatic hydrocarbons 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 or larval success. Growth abnormalities. Behavioural disruption.
Fish, including sharks and rays	The coating of adults, but primarily eggs and larvae causes reduced mobility and reduced 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 dissolved aromatic hydrocarbons across cellular membranes (e.g. gills).	Mortality. Cell damage. Flesh taint. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
				Reduced egg or larval success. Growth abnormalities. Behavioural disruption.
Birds (seabirds and shorebirds)	Degree of coating depends on the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	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.	Mortality. Cell damage, lesions. Secondary infections. Reduced metabolic capacity. Reduced immune response. Disease. Reduced growth. Reduced reproductive output. Growth abnormalities. Behavioural disruption.
Marine reptiles	Degree of coating depends on the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	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	Fur damage and matting, reduced mobility and buoyancy (for applicable species). Coating of feeding apparatus in some species (i.e. baleen whales).	Irritation of eyes/mouth, damage to fur 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 reproductive output. Growth abnormalities. Behavioural disruption.
Plankton	Coating of feeding apparatus. Reduced mobility and capacity for oxygen exchange.	Mortality. Behavioural disruption (for example, reduced mobility).	Inhalation. Ingestion. External contact.	Mortality. Impairment of biological activities (for example, feeding, respiration). Reduced mobility.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
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 range.	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, shoreline habitats and marine fauna/flora within protected areas as discussed in rows above.	Mortality, injury or behavioural disruption to marine fauna. Death or 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 fauna. Death or 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.
Socio-economic environment (fisheries, tourism, shipping, defence, shipwrecks, Indigenous users, oil and gas)	Presence of hydrocarbon residue in the water, which may filter down to sediments or continue to biodegrade on the surface. Coating of benthic habitats, shoreline habitats and marine fauna/flora within protected areas as discussed in rows above.	Degradation of cultural or maritime heritage sites. Disruption to tourism, recreation or shipping activities. Reduction in resource available for commercial and recreational fisheries.	Impacts to flora, fauna and the physical environment as discussed in rows above. Commercial/recreational fish species – refer to 'fish' as discussed above.	Degradation of cultural or maritime heritage sites. Disruption to tourism, recreation or shipping activities. Reduction in resource available for commercial and recreational fisheries.

7.6.6.6 Summary of potential impacts

Table 7-14 provides a summary of the potential impacts of hydrocarbon releases to sensitive receptors.

Table 7-14: Nature and scale of hydrocarbon spills on environment and socio-economic receptors

Receptor	Nature and Scale of Hydrocarbon Spills
Marine fauna	
Marine mammals	• Eleven migratory marine mammal species were identified by the EPBC Protected Matters search for the EMBA (Section 3.2.7). Of these, two are listed as endangered (blue whale and southern right whale) and four as vulnerable (Australian snubfin dolphin, Australian humpback dolphin, fin whale and sei whale). • The humpback whale BIA for migration (north and south) (Table 3-10 and Figure 3-11) are within the extent of the EMBA. • Other migratory marine mammals may encounter either surface or water-column hydrocarbons within the extent of the EMBA; however, in the absence of any known feeding, resting or breeding areas, significant numbers are unlikely to be contacted.
Marine reptiles	• Seven species of threatened marine reptile were identified as possibly being contacted by a spill. Short-nosed seasnake, leaf-scaled seasnake, saltwater crocodile, flatback, hawksbill, leatherback, green and loggerhead turtles are widely dispersed at low densities across the North West Shelf; and in the unlikely event of a hydrocarbon spill occurring, individuals traversing open water may come into contact with water-column or surface hydrocarbons. • BIAs and critical habitat for the flatback turtle, green turtle, hawksbill turtle and loggerhead turtle all are within the extent of the EMBA (Table 3-10 and Figure 3-12).
Fish, sharks and rays	• Eight threatened species of fish, sharks and rays are known to or may occur in the EMBA. Of these, whale sharks are the only species with a BIA (foraging) that intersects the EMBA. However, the main whale shark aggregation location is Ningaloo Marine Park which does not intercept the EMBA. • Given the absence of critical habitat for most of the threatened species within the EMBA, significant numbers are not expected to be exposed to hydrocarbons in the event of a spill.
Seabirds and shorebirds	• Nineteen threatened species of seabirds and shorebirds were identified by the EPBC Protected Matters database search as being within the EMBA (Table 3-9). The wedge-tailed shearwater, lesser crested tern, Australian fairy tern and roseate tern have breeding BIAs that overlap the EMBA. • Surface and entrained condensate/diesel is unlikely to contact nesting or egg-laying individuals in colonies; however, it is possible that individuals could come in contact with surface, entrained or dissolved aromatic hydrocarbons while foraging.
Plankton (including zooplankton and fish and coral larvae)	• The EMBA has the potential to overlap with spawning of some fish species given the year-round spawning of some species. In the unlikely event of a spill occurring, fish larvae may be contacted by hydrocarbons (condensate, diesel) entrained in the water column.
KEFs	There are no key ecological features within the EMBA. Given the absence of KEFs within the EMBA, no exposure to hydrocarbons is unlikely in the event of a spill.
Socio-economic	
Fisheries	• Several commercial and state fisheries are found within the EMBA and moderate hydrocarbon exposure value described in Section 3.2.8. • Fisheries may be impacted by surface hydrocarbons and fish stocks may be impacted by entrained and dissolved hydrocarbons.
Tourism	• There are many sources of marine-based tourism within the EMBA, and moderate hydrocarbon exposure value described in Section 3.2.8. • Aquatic recreational activities, such as boating, diving and fishing, occur around the Montebello Islands but are predominantly concentrated in the vicinity of the population centres such as Dampier.

Receptor	Nature and Scale of Hydrocarbon Spills
	• Tourism is expected to be impacted by surface hydrocarbons and exclusion zones surrounding a spill will reduce access for vessels for the duration of the response undertaken for spill clean-up (if applicable) and may prevent water based tourism activities in certain areas.
Shipping	• A number of shipping fairways intersect the EMBA. • In the event of a hydrocarbon spill chipping activities may be impacted by exclusion zones surrounding a spill. Exclusion zones could reduce access for shipping vessels for the duration of the response undertaken for spill clean-up (if applicable) meaning vessels may have to take detours leading to potential delays and increased costs.
Defence	• Military exercise areas are located at Exmouth and Derby associated with the RAAF Base Learmonth and Curtin respectively. These training zones overlap the EMBA. However, they have been for aerial training are unlikely to be impacted by a hydrocarbon spill.
Shipwrecks	• There are a number of shipwrecks in the EMBA and the MEVA. • Surface hydrocarbons will have no impact on shipwrecks. • Hydrocarbons in the water column either as entrained oil or dissolved aromatic hydrocarbons may extend several hundreds of kilometres from the release location. The potential for in-water hydrocarbons to impact on shipwrecks is poorly documented; however, it has been proposed that exposure to oil and/or dispersant may alter bacterial community composition (biofilms) inhabiting shipwrecks, possibly altering corrosion potential (Salerno *et al*., 2016).
Indigenous users	• Marine resource use by indigenous people is generally restricted to coastal waters. Fishing, hunting and the maintenance of maritime culture and heritage through ritual, stories and traditional knowledge continue as important uses of the nearshore region and adjacent areas. • Indigenous users may be impacted by surface hydrocarbons, exclusion zones around spill sites during spill response and fishing and hunting stocks may be impacted by entrained and dissolved hydrocarbons.
Existing oil and gas activity	• Exclusion zones surrounding spills will reduce access, potentially resulting in delays to work schedules with possible subsequent financial implications. In particular, Chevron's Gorgon and WA Oil operations on Barrow Island may be impacted in the event of an unplanned spill event through exclusion or access restrictions in the event of spill response and clean-up activities (if applicable).
Protected areas	Protected areas within the EMBA are summarised below. For full descriptions of these areas refer to Section 3.2.4 and Appendix C. • National Heritage Listed Areas: – Dampier Archipelago (including Burrup Peninsula) • Australian Marine Parks: – Montebello AMP – Dampier AMP • State Marine Parks and Marine Management Areas: – Barrow Island WA Marine Park – Montebello Islands WA Marine Park – Barrow Island Marine Management Area Protected areas are protected based on a number of values and these values can be impacted by both surface and subsurface hydrocarbons.

7.7 Subsurface release of hydrocarbon from the DC pipeline

7.7.1 Description of event

Event	***Leaking or ruptured pipeline (3.75 hour subsea leak of 121.4 m^3 of Reindeer condensate near the HDD crossing and (3.71 hour subsea leak of 121.4 m^3 of Reindeer condensate) at the State/Commonwealth waters boundary)*** It is considered credible that an unplanned release of condensate could occur from the subsea pipeline. This maximum credible spill would result in a subsea pipeline leak of 121.4 m^3 of Reindeer condensate over 3.75 hours. This is to represent Reindeer pipeline late life operations scenarios; this can be taken as the maximum condensate volume contained within the pipeline between isolation points at the WHP and the DCGP plus the condensate contained within an hour of flow. Suspension phase operations have neglected condensate in-flow given the pipeline is assumed to be shut-in. There are no events identified that could result in a pin hole leak in a pipeline less than the low-pressure alarm trigger (6000 kPa), other than a cyclone. For the purpose of this section 'the spill scenario' refers to the maximum credible spill from a subsea pipeline leak, unless otherwise stated.
Extent	The subsea release from the pipeline spill scenario is credible anywhere along the pipeline in State waters. Predictive oil spill modelling for a subsea release from the pipeline of 121.4 m^3 of Reindeer condensate at the CSB and HDD crossing have been modelled as the locations are both close to sensitive receptors. The extent of a subsurface release of hydrocarbon is different at the State/Commonwealth waters boundary and the HDD boundary as described below: • HDD site: The maximum extent of hydrocarbon exposure at the low exposure value is 6 km from the release location from the dissolved aromatic hydrocarbon (10 ppb). The floating, entrained and accumulated hydrocarbon fates fit within this extent. • State/Commonwealth boundary release: The maximum extent of hydrocarbon exposure at the low exposure value is 127 km from the release location from the dissolved aromatic hydrocarbon (10 ppb). The floating, entrained and accumulated hydrocarbon fates fit within this extent. The MEVA and EMBA for the worst-case hydrocarbon spill was defined in Section 3.1 and shown in Figure 3-1. The EMBA is used to inform the impact assessment in this section. A slow release from a pipeline below the low-pressure alarm trigger is credible post cyclone. Post a significant cyclone event, the entire pipeline may be inspected in accordance with the Subsea Inspection Procedure (SO-35-IS-00001). The rate and volume of this type of leak would be orders of magnitude lower than the maximum credible spill from a subsea pipeline assessed in this EP and therefore the extent of this scenario is considered to be within the extent assessed for the maximum credible spill from a subsea pipeline and has not been individually modelled.
Duration	3.75 hours at HDD crossing, 3.71 hours at CSB.

7.7.2 Nature and scale of environmental impacts

Hydrocarbon spills will cause a decline in water quality and may cause physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface) and chemical (e.g. toxic) impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (i.e. extent, duration) and the sensitivity of the receptor. Given the diesel and the condensate are considered light hydrocarbons (Group 1 and 2 hydrocarbons; AMSA, 2005), the physical and chemical pathways to impact are comparable. Therefore, both are presented in Table 7-13.

Potential Receptors: Intertidal and subtidal habitats, marine and coastal fauna, commercial and recreational fishing, socio-economic receptors, Commonwealth and State marine protected areas

Reindeer Condensate is considered a light hydrocarbon. In the event of a surface spill, these undergo rapid spreading and evaporative loss in warm waters. As the condensate is more buoyant than water, during a subsea release scenario, any hydrocarbon that rise to float on the sea surface will also undergo the same evaporation and spreading loss. A temporary slick on the sea surface, and entrained hydrocarbon in the sea surface layer, could have the physical effect of coating fauna interacting within and under the surface slick, including plankton, pelagic invertebrates and fishes, marine reptiles, marine mammals and seabirds, and may also cause slight secondary effects through ingestion after preening for seabirds, or through ingestion of oiled fish. In the event that the slick and entrained hydrocarbon reaches coastlines and shallow waters, shoreline, intertidal and subtidal habitats may also be oiled.

A subsea release under pressure, such as a pipeline rupture scenario described is expected to have a greater percentage of dissolved aromatic hydrocarbons distributed throughout the water column. These aromatic hydrocarbons, including monocyclic aromatic hydrocarbons and low molecular weight polycyclic aromatic hydrocarbons, can cause narcotic effects in fauna if concentrations and exposure are sufficiently high and long respectively. Narcotic effects of dissolved aromatic hydrocarbons are considered unlikely to occur from a spill of marine diesel or condensate of the size possible under operations. The dissolved aromatic hydrocarbons that tend to be toxic (e.g. monocyclic aromatic hydrocarbons such as benzene, toluene, ethylbenzene and xylene (BTEX)

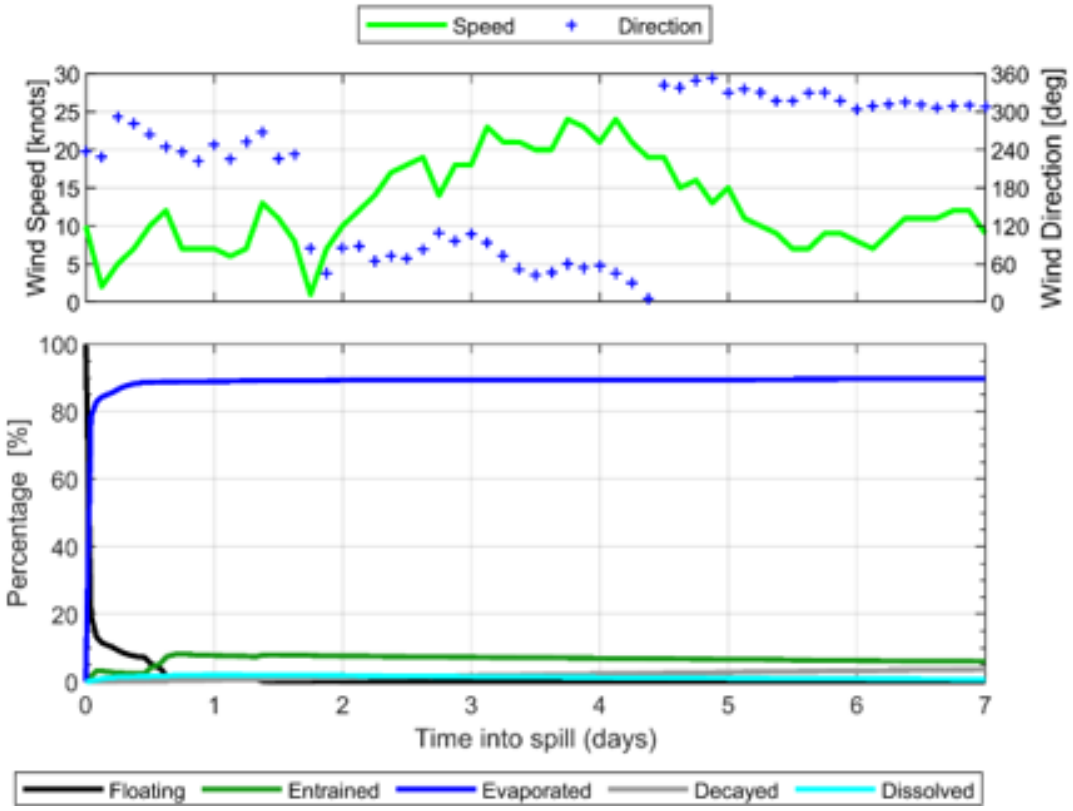
chemicals) are also rapidly lost to the atmosphere through evaporation as they evaporate faster than they can dissolve in the water column due to their high volatility (French-McCay, 2002).

The intertidal and shoreline habitats at receptors within the EMBA and the sensitivities of these receptors to hydrocarbons are provided in Table 7-13. Further detailed information on the receptors can also be found in Appendix C.

7.7.2.1 Spill modelling results

Modelling results have been provided for each of the four hydrocarbon fates: shoreline accumulation; surface; dissolved and entrained.

Weathering characteristics of Reindeer condensate when released from the sea surface under variable wind conditions are shown in Figure 7-2**.**



Source: RPS (2024)

Figure 7-2: Mass balance plot representing the weathering of Reindeer condensate spilled into the water column as a one-off release (50 m^3 over 1 hour) and subject to variable wind speeds of 2–23 knots (1–12 m/s) at 27 °C water temperature and 25 °C air temperature

These results show little oil mass predicted to persist on the sea surface after seven days (less than 1%) as a result of wind conditions. Variable wind speeds generate significant entrainment events. For the variable wind speed case (Figure 7-2) where the winds are variable and of greater strength, after 24 hours, 88.9% of the condensate mass had evaporated and 7.9% is shown to have entrained, leaving only a small proportion floating on the water surface (~0.7%). The low volatile and residual components will tend to entrain beneath the surface under conditions that generate wind waves (> ~12 knots). Biological and photochemical degradation is predicted to contribute to the more gradual decay of the floating slick.

The modelling results are presented below for the fate of hydrocarbon at the exposure values described in Section 7.6.5. Table 7-15 has been provided for the purposes of risk evaluation, displaying the following parameters:

- Minimum time to contact from moderate and high exposure value
- Maximum hydrocarbon concentration from high exposure value
- Maximum oil loading on shoreline from moderate and high exposure value
- Length of shoreline oiled.

Further parameters required to inform spill response strategies are described further in the OPEP.

Oil spill modelling results show that the two spill scenarios (HDD crossing location and the State/Commonwealth waters location) have different impact levels on nearby receptors. As such both release locations are considered for this impact assessment.

Commonwealth State Boundary modelling results

Floating oil – CSB results

Low

Stochastic modelling determined that floating oil is expected to remain localised around the spill location, with floating oil at the low exposure value being expected up to 8 km from the spill site at concentrations of 1 g/m^2. No EVAs are expected to be contacted at the low exposure value for floating hydrocarbons.

Moderate

Stochastic modelling determined that there will be no dispersal of floating oil at the moderate exposure value of 10 g/m^2 from the spill site. No EVAs are expected to be contacted at the moderate exposure value for floating hydrocarbons.

High

Stochastic modelling determined that there will be no dispersal of floating oil at the high exposure value of 50 g/m^2 from the spill site. No EVAs are expected to be contacted at the high exposure value for floating hydrocarbons.

Shoreline accumulation - CSB results

No shoreline accumulation is predicted for this scenario at, or above, the 10 g/m^2 threshold. Therefore, no EVAs are expected to experience shoreline accumulation of hydrocarbons, at all exposure values.

Dissolved oil - CSB results

Low

Stochastic modelling determined that dissolved oil at the low exposure value of 10 ppb is expected to reach up to 127 km from the spill site. The maximum probability of contact is at the Dampier AMP at 1%. All other receptors have predicted contact <1%.

Moderate

Stochastic modelling determined that dissolved oil at the moderate exposure value of 50 ppb may reach up to 82 km from the spill site. Several receptors have predicted contact <1% including: Dampier AMP, Madeleine Shoals and Montebello AMP. All other receptors have no predicted contact at the moderate exposure value for dissolved hydrocarbons.

High

Stochastic modelling determined that dissolved oil at the high exposure value of 400 ppb may reach up to 27 km from the spill site. No EVAs are expected to be contacted at the high exposure value for dissolved hydrocarbons.

Entrained oil - CSB results

Low

Stochastic modelling determined that entrain oil at the low exposure value of 1,000 ppb may reach up to 9 km from the spill site. No EVAs are expected to be contacted at the low exposure value for entrained hydrocarbons

HDD Crossing Modelling Results

Floating oil - HDD Crossing

Low

Stochastic modelling determined that floating oil is expected to remain localised around the spill location, with floating oil at the low exposure value being expected up to 6 km from the spill site at concentrations of 1 g/m^2. No sensitive receptors are expected to be contacted at the low exposure value for floating hydrocarbons.

Moderate

Stochastic modelling determined that there will be no dispersal of floating oil at the moderate exposure value of 10 g/m^2 from the spill site. No sensitive receptors are expected to be contacted at the moderate exposure value for floating hydrocarbons.

High

Stochastic modelling determined that there will be no dispersal of floating oil at the high exposure value of 50 g/m^2 from the spill site. No sensitive receptors are expected to be contacted at the high exposure value for floating hydrocarbons.

Shoreline accumulation – HDD crossing

Shoreline accumulation is expected to only occur at the Northern Coast Islands within the EMBA with the maximum volume expected to be 8 m^3. Specific details of shoreline accumulation are provided below in the context of the low, moderate and high exposure values.

Low

There is a 28.33% probability of contact at this exposure value at Northern Islands Coast. With a maximum accumulated volume along this shoreline with concentrations >10g/m^2 of 8m^{3}and a maximum length of 5km in the worst simulation.

Moderate

There is a 11% probability of contact at this exposure value at Northern Islands Coast. With a maximum accumulated volume along this shoreline with concentrations >100g/m^2 of 8m^3 and a maximum length of 3km in the worst simulation.

High

No sensitive receptors are expected to experience shoreline accumulation of hydrocarbon at the high exposure value.

Dissolved oil – HDD crossing

Low

Stochastic modelling determined that dissolved oil at the low exposure value of 10 ppb is expected to reach up to 6 km from the spill site. No sensitive receptors are expected to be contacted at the low exposure value for dissolved hydrocarbons.

Moderate

Stochastic modelling determined that there will be no dispersal of dissolved oil at the moderate exposure value of 50 ppb from the spill site. Therefore, no sensitive receptors are expected to be contacted at the moderate exposure value for dissolved hydrocarbons.

High

Stochastic modelling determined that there will be no dispersal of dissolved oil at the high exposure value of 400 ppb from the spill site. Therefore, no sensitive receptors are expected to be contacted at the high exposure value for dissolved hydrocarbons.

Entrained oil – HDD crossing

Stochastic modelling determined that no entrained oil was predicted to occur at, or above, the low threshold value of 1,000 ppb. Therefore, no sensitive receptors are expected to be contacted at the low threshold value for entrained hydrocarbons.

Table 7-15: Modelling results for subsurface release of hydrocarbons from the DC Pipeline

Receptor	Receptor Type	Minimum time to contact (hours)							Maximum hydrocarbon concentration					Max. local accumulated concentration	Max. accumulated volume (m^3)	Max. length of shoreline (km)
		Moderate exposure values				High exposure values			Moderate exposure values							
		Shoreline accumulation 100 g/m^2	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbon (1000 ppb)	Shoreline accumulation (1000 g/m^2)	Surface hydrocarbons (50 g/m^2)	Dissolved hydrocarbons (400 ppb)	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbon (1000 ppb)	Surface hydrocarbons (50 g/m^2)	Dissolved hydrocarbons (400 ppb)	Shoreline accumulation g/m^2	Shoreline accumulation >100g/m^2	Shoreline accumulation >100g/m^2
Subsurface release of hydrocarbons from the DC Pipeline – CSB Location																
Barrow-Montebello Surrounds	Submergent	NC	NC	NC	NC	NC	NC	NC	NC	11	NC	NC	NC	NC	NC	NC
Dampier AMP	Submerged	NC	NC	192	NC	NC	NC	NC	NC	62	NC	NC	NC	NC	NC	NC
Dampier Archipelago	Emergent	NC	NC	NC	NC	NC	NC	NC	NC	26	NC	NC	NC	NC	NC	NC
Madeleine Shoals	Submerged	NC	NC	182	NC	NC	NC	NC	NC	65	NC	NC	NC	NC	NC	NC
Montebello AMP	Submergent	NC	NC	198	NC	NC	NC	NC	NC	79	NC	NC	NC	NC	NC	NC
Subsurface release of hydrocarbons from the DC Pipeline – HDD crossing Location																
Northern Islands Coast	Emergent	3	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	484	8	3

NC= No Contact

7.7.3 Environmental performance objectives and control measures

The EPO relating to this event:

- No loss of containment of hydrocarbon to the marine environment (EPO-DC-08).

Control measures applied to prevent an oil are shown in, and corresponding EPSs and measurement criteria are described in Table 8-2.

Selection of oil spill response strategies and associated EPOs, control measures and EPSs, including those required to maintain preparedness and for response, are detailed within the OPEP. The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-16: Control measures evaluation for subsea release of condensate from subsea pipeline

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-13	Planned subsea and offshore maintenance.	Administrative	Reduces likelihood of leaks from equipment and ensures ongoing integrity of subsea infrastructure.	Personnel and operational costs associated with undertaking regular inspections of all subsea equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
DC-CM-14	Anchoring and equipment deployment management.	Administrative	Anchoring and placement of equipment is controlled through ensuring any anchoring occurs at pre-approved locations, therefore reducing potential environmental impacts.	Costs associated with implementing procedures.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-15	Navigational charting of infrastructure.	Administrative	Provides a means for marine users to be aware of the presence of the subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-33	Dropped object prevention procedures	Administrative	Impacts to environment are reduced by preventing dropped objects. Minimises dropped object risk during lifting operations. Requires lifting equipment to be certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-39	Emergency response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Administrative	Implements the ESD system quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine and terrestrial environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-41	Inspection of hydrocarbon-containing equipment.	Administrative	Reduces likelihood of leaks from subsea infrastructure to the marine environment.	Personnel and operational costs associated with undertaking inspections.	**Adopted** – Benefits of the inspection to determine operational integrity outweigh the cost to undertake the inspection.
DC-CM-42	Testing and maintenance of ESD systems and shutdown or safety valves.	Administrative	Maintenance and testing of emergency systems and shutdown valves enable potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-43	Accepted oil pollution emergency plan (OPEP).	Administrative	Implements response plan to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs associated with preparing documents, ongoing management (spill response exercises) and implementation of OPEP.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
DC-CM-44	DEMIRS accepted safety case.	Administrative	Includes control measures for pipeline integrity and management controls.	Costs associated with personnel time in writing, reviewing and implementing the safety case.	**Adopted** – Benefits considered to outweigh costs. Regulatory requirement must be adopted.
DC-CM-45	Inspection and corrosion monitoring.	Administrative	Regular inspections reduce the risk of leaks from subsea pipelines by confirming appropriate integrity.	Costs associated with personnel time in performing the inspections, monitoring and reporting inspections and follow up actions.	**Adopted** – Benefits considered to outweigh costs.
Additional Control Measures					
N/A	Fly over inspection of pipelines during helicopter transfers.	Administrative	Identification of bubbles at the sea surface may indicate a potential leak from a subsea pipeline that would be further investigated and therefore limit the potential volume of a spill event.	Costs associated with helicopter and training of crew to observe.	**Rejected** – A safe distance above sea level needs to be maintained by the helicopter. In order to observe any bubbles at the sea surface, weather conditions and sea state would need to be flat and calm. Based on these limitations, this is not deemed an effective stand-alone control.

7.7.4 Environmental impact assessment

The below environmental impact assessment follows the risk assessment approach detailed in Section 7.6.6.

7.7.4.1 Identification of hotspots for consequence assessment

As described in Section 7.6.6 all HEVs within the EMBA (low exposure value) for this scenario are listed, as only the Northern Islands Coast is contacted by any hydrocarbon phase at both low and moderate threshold, this HEV is selected as a hotspot. No receptors meet the Hotspot criteria detailed in Section 7.6.6, for the pipeline leak at the CSB as all contact is <1% probability, therefore the hotspot consequence assessment has been completed on the HDD Crossing scenario (Scenario 3) only. The hotspot meets the criteria for >5% probability of contact at one or more of the hydrocarbon phases (shoreline accumulation at low and moderate thresholds).

Table 7-17 provides a simplified summary of the consequence assessment results for the Northern Island Coast Hotspot. The consequence assessment was based on predicted contact and concentration of floating oil, accumulated oil, entrained oil and dissolved hydrocarbons. For this Hotspot area the consequences to the key values were assessed using the methodology described in Section 5.

Table 7-17: Hotspot consequence summary

Receptor name	HEV ranking	Values	Oil spill modelling parameter		Surface LOWC release	Consequence category	Worst-case consequence ranking	Total
Northern Islands Coast (emergent)	3	Habitats • Reefs • Great Sandy Islands Nature Reserve • Algae • Fish habitat Seabirds • Behavioural BIAs for fairy tern, roseate tern and wedge-tailed shearwater Turtles • Behavioural BIAs for flatback, green and hawksbill turtles Whales • Humpback (Jun–Jul) Socio-economic • Commercial fisheries • Significant recreational fishing Heritage values • Dampier archipelago (including Burrup Peninsula)	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• II • II • II • II	II
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NA			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	8			
			Maximum accumulated concentration	(g/m2)	484			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	3			
			Maximum concentration of entrained oil	(ppb)	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NA			
			Maximum concentration of dissolved hydrocarbons	(ppb)	59			
			Minimum time to contact by dissolved oil ≥50 ppb	Time (h)	598			

Leaking or ruptured pipeline (3.75 hour subsea leak of 121.4 m^3 of Reindeer condensate) near the HDD crossing and at the (3.71 hour subsea leak of 121.4 m^3 of Reindeer condensate) State/Commonwealth waters boundary)	
Receptors	Threatened, migratory or local fauna Protected areas Physical environment or habitats Socio-economic receptors
Pre-treatment consequence	III – Moderate for both CSB and HDD crossing locations
Consequence	III - Moderate for both CSB and HDD crossing locations

Marine Fauna

In the event of a pipeline release, the volume of hydrocarbons released would be the entire volume within the pipeline between isolation points, that is 121.4 m^3 condensate based on the full pipeline inventory during late life operations. Given the nature of condensate (light hydrocarbon) and dilution and dispersion from natural weathering processes (such as ocean currents), the extent of exposure will be limited in area and duration.

The susceptibility of marine fauna to hydrocarbons is dependent on hydrocarbon type and exposure duration. However, given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is not expected to result in a fatality.

Deteriorating water quality/chemical and terrestrial discharge is identified as a potential threat to turtles in the marine turtle recovery plan, and some bird and shark species. Habitat modification, degradation and disruption, pollution and/or loss of habitat are also identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. With controls in place, that are in line with relevant actions described in various recovery plans, the activity will be conducted in a manner that reduces potential impacts to ALARP and an acceptable level.

In the unlikely event that a pipeline rupture did occur and resulted in a condensate release from the pipeline, the potential impacts to the environment would be greatest within several kilometres from the release location, when the toxic aromatic components of the fuel will be at their highest concentration. Condensate will rapidly lose toxicity with time and spread thinner as evaporation continues. The potential sensitive receptors in the surrounding areas of the spill will include those in the water column, such as fish, marine mammals, marine reptiles and submerged habitats. Receptors at the sea surface and on shorelines may also be impacted from a pipeline rupture. Hydrocarbons that reach nearshore environments have the potential to impact benthic coral reefs and mangrove areas, which may result in a long-term decrease in ecological values, given toxicity impacts associated with hydrocarbon exposure.

Protected Areas

Impacts to the habitat or fauna receptors described above have an impact on the values of AMPs and marine management areas, which could have flow-on effects to tourism revenue of coastal communities that provide access to these marine reserves. Many of these receptors are values of protected areas and there could be a major effect on them.

Socio-economic Receptors

There is the potential for entrained oil to temporarily disrupt fishing activities if the surface or entrained oil moves through fishing areas.

Tourism could be affected by spilled condensate, either from reduced water quality or shoreline oiling preventing recreational activities or reducing aesthetic appeal, or from impacts to habitats and marine fauna.

On the basis of the above assessments, a condensate release from a pipeline rupture has the potential to impact receptors in the water column regardless of the location being at the CSB or the HDD crossing. Given the extent, the worst-case consequence is considered to be –III - Moderate for both locations.

Likelihood	a - Remote

A hydrocarbon release resulting from a pipeline rupture caused by an integrity or corrosion issue, dropped object or anchor drag is unlikely to have widespread ecological effects, given the nature of the condensate, controls in place, the safety design of the production system, the limited volumes that could be released, the water depth and the transient nature of marine fauna in this area.

Deteriorating water quality is identified as a potential threat to turtles in the marine turtle recovery plan, and some bird and shark species (Table 3-9). Habitat modification, degradation, disruption, pollution or loss of habitat are also identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. However, the potential hydrocarbon releases as a result of pipeline rupture are not expected to significantly impact the receiving environment, based on the management controls proposed. Additionally, long-term impacts resulting in complete habitat loss or degradation are not considered likely, given the controls proposed to prevent releases; therefore, the activity will be conducted in a manner that is considered acceptable.

The likelihood of a pipeline rupture at both the CSB and HDD locations was considered, and given the low frequency of vessels in the area and the usual size being those of recreational size (given proximity to coastline), the assumption is that small vessel anchors will not cause damage to the pipeline.

The likelihood of a hydrocarbon release occurring due to pipeline rupture is limited, given the set of mitigation and management controls in place. Consequently, the likelihood of a pipeline rupture releasing hydrocarbons to the environment which results in a moderate consequence is considered to be a-Remote.

Leaking or ruptured pipeline (3.75 hour subsea leak of 121.4 m^3 of Reindeer condensate) near the HDD crossing and at the (3.71 hour subsea leak of 121.4 m^3 of Reindeer condensate) State/Commonwealth waters boundary)	
Residual Risk	Very Low.

7.7.5 Demonstration of ALARP

Since the transfer of condensate and gas to DCGP processing facilities is an integral part of operational activities, the risk of a condensate spill from a pipeline cannot be completely eliminated along the length of the pipeline.

The identified causes of pipeline rupture from external factors is through a loss of integrity or corrosion, dropped objects and anchor drag. A number of procedural controls are in place which reduce the likelihood of these events. Eliminating the potential for dropped objects and anchoring is not feasible since vessel activity is also inherent in the operational activities (e.g. inspection or maintenance activities using ROVs or divers).

The subsea pipelines are designed to reduce the potential for rupture and release of condensate and gas to the marine environment. The integrity of the subsea production system is maintained through planned inspection, monitoring and testing of its components, ensuring that the system operates within its design requirements and there is no unacceptable degradation of the system (e.g. materials, or ESD valve shutdown time or leakage).

The primary mechanism to immediately respond to a release of hydrocarbon from the subsea is via the emergency shutdown system managed through the Devil Creek Emergency Response Plan (DC-40-IF-00096). This system responds to both automatic and manual activation, with automatic activation triggered by abnormal process conditions, such as pressure drop across the subsea production system. The emergency shutdown system functionality and reliability is maintained through regular testing of the shutdown systems and the subsea valves. The regular testing and maintenance of the emergency shutdown and blowdown systems are managed through Performance Standard Assurance Plans (PSAPs), which provide the work instructions and performance criteria to test and service the shutdown and blowdown systems against. The relevant PSAPs contain specific performance criteria as detailed below:

- PS-06 ESD and Blowdown: Emergency Shutdown Valves (ESDVs) (DC-00-RG-00027). The performance criteria specified in PS-06 includes:
  - Appropriate ESDV location, ESDV close on demand timings, process safety time calculation, acceptable leak rates of the ESDV (as per American Petroleum Institute), ESDV signage, ESDV alarm, leakage testing, position testing alarms.
- PS-08 ESD and Blowdown: Safety Instrumented Systems (DC-00-RG-00029). The performance criteria for Safety instrumented Systems in PS-08 includes:
  - ESD pushbuttons, status of SIS elements display requirements, reliability/availability achievement and testing requirements, logic Solver location requirements electrical tripping device.
- PS-10 ESD and Blowdown: Pressure Safety Valves (DC-00-RG-00031). The performance criteria specified in PS-10 includes:
  - Relief system designed and operated in accordance with American Petroleum Institute, set PSV relief pressure, PSV reliability /availability function testing and examinations.

The relevant PSAPs are listed as control measures with relevant performance standards in Section 8.4.1. These performance standards are not applicable during the CoP phase once the hydrocarbon has been removed/flushed from the pipeline.

The maintenance and regular testing of the shutdown systems and the subsea valves managed through the PSAPs ensures available, reliable, survivable and independent control ensuring the emergency shutdown and blowdown functionality, resulting in near-instantaneous shut in following loss of pressure, and is considered to reduce the spill volume to ALARP for a unplanned release of condensate from the DC Pipeline.

In terms of spill response activities, Santos will implement oil spill response as specified in the OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the OPEP.

7.7.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes –Maximum credible spill volume from a subsea pipeline (max. 121.4 m^3) residual risk is ranked as Very Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.

Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with P(SL)(E) Regulations including safety case. Santos has considered the values and sensitivities of the receiving environment including, but not limited to: • Conservation values of the identified protection priorities including the Montebello Australian Marine Park, the Barrow Island Marine Park Management Area and Muiron Island Marine Management Area • Relevant species recovery plans, conservation management plans and management actions set out in Table 3-11.
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The likelihood of a subsea condensate release from a pipeline is remote when considering industry statistics, Santos statistics and the preventive controls in place. Additional industry standard and activity-specific control measures to reduce the chance of the event occurring (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the safety case, personnel training and awareness, and a spill response plan (the OPEP). In accordance with Santos' risk assessment process, the residual risk is considered to be Very Low and ALARP. The proposed control measures will reduce the risk of impacts from a subsea pipeline condensate release to a level that is considered acceptable.

7.8 Surface release of diesel (vessel collision/bunkering)

7.8.1 Description of event

Event	***Short term release of 325 m³ of Marine Gas Oil at the water surface over 1 hour at the HDD shoreline crossing and Commonwealth–State boundary*** A vessel to vessel collision at the HDD breakthrough location (2.38 km from the MLWM) potentially resulting in a diesel spill onto the water surface was assessed, based on a release of 325 m³ over 1 hour. This total volume is a conservative estimate of the MCS possible for these activities; 325 m³ is used to account for the selected vessel type that will be used by Santos in conducting offshore activities. Importantly, due to the water depth within State waters, vessels with a much smaller MCS are more likely to be used for the activities described in this EP; these also have a total fuel capacity much less than 325 m³. Based on modelling, the surface slick is predicted to spread out rapidly to form a thin film on the sea surface, and a large proportion of it (30%) is predicted to evaporate within 24 hours of release. Over time, the diesel will become increasingly subject to entrainment into the water column as the density increases after losing the lighter components through evaporation. The rate of entrainment will be influenced by sea conditions (wind and wave action) at the time of the spill. A release of diesel at the Commonwealth-State waters boundary was also assessed with a release over a 1-hour period, yielding a total release volume of 325 m³.
Extent	The EMBA for the worst-case hydrocarbon spill was defined in Section 3.1. The extent of a subsurface release of hydrocarbon is different at the State/Commonwealth waters boundary and the HDD boundary as described below: • HDD site: The maximum extent of hydrocarbon exposure at the low exposure value is 19 km from the release location from the dissolved aromatic hydrocarbon (10 ppb). The floating, entrained and accumulated hydrocarbon fates fit within this extent. • State/Commonwealth boundary release: The maximum extent of hydrocarbon exposure at the low exposure value is 125 km from the release location from the dissolved aromatic hydrocarbon (10 ppb). The floating, entrained and accumulated hydrocarbon fates fit within this extent.
Duration	1 hour

7.8.2 Nature and scale of environmental impacts

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g. toxic) 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 spill depends on the magnitude of the spill (i.e. extent, duration) and sensitivity of the receptor.

Potential Receptors: Shallow benthic, intertidal and shoreline habitats, plankton, invertebrates, fish, marine mammals, marine reptiles, birds (seabirds and shorebirds), fisheries, oil and gas industry, tourism, KEFs and marine reserves

A surface release of diesel to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column near the location of the spill. Shoreline accumulation greater than 100 g/m^2 occurs at various locations. The highest probability of oil accumulation was forecasted for Montebello Islands (9.33%) at, or above, 10 g/m^2. Dampier Archipelago registered the maximum volume of 24 m^3, as well as the shortest time before oil accumulation at 56 hours from the CSB spill location. Whilst at the HDD location, the highest probability of oil accumulation was forecasted for Northern Islands Coast at 47.67% at or above the 10 g/m^2 threshold, and the probability reduced to 28% for accumulation above the 100 g/m^2 threshold The same EVA registered the maximum volume of 199 m^3, as well as the shortest time before oil accumulation at 2 hours.

To account for a diesel release that may occur anywhere within Commonwealth waters and closer to sensitive receptors, potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-13, and potential impacts to receptors found within the EMBA are further described in Table 7-14.

7.8.2.1 Spill modelling results

The release was modelled at two locations: at the DC pipeline intersecting the State-Commonwealth waters boundary and at the HDD shoreline crossing; the latter represents the worst-case location where a vessel spill could occur as a result of the activities covered in this EP (i.e. closest to shallow or shoreline habitats).

The International Tanker Owners Pollution Federation (2011) and AMOSC (2011) categorise diesel as a light ‘group II’ hydrocarbon. In the marine environment, a 5% residual of the total quantity of diesel spilt will remain after the volatilisation and solubilisation processes associated with weathering.

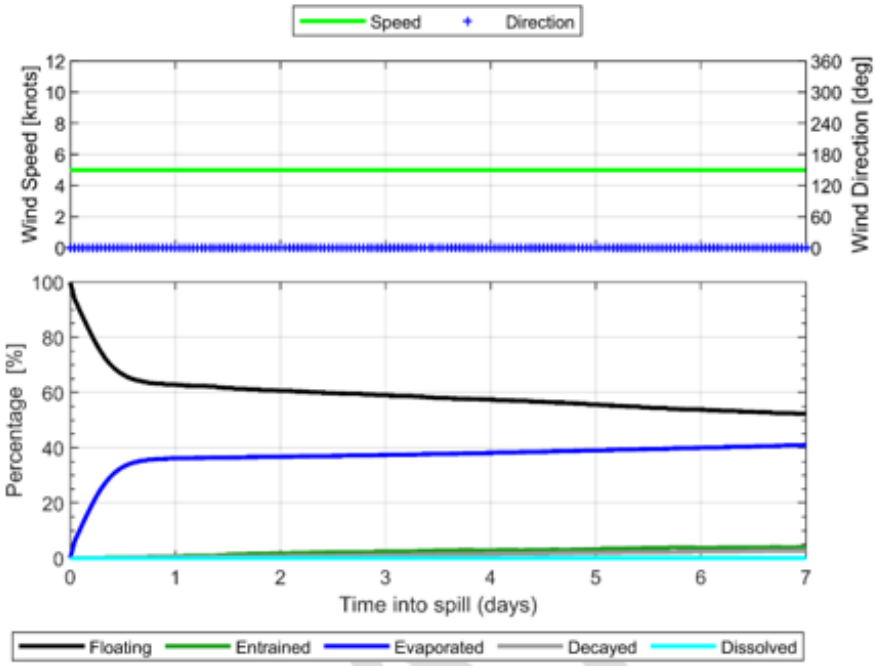
In the marine environment, diesel is expected to behave as follows:

- Diesel will spread rapidly in the direction of the prevailing wind and waves

- Evaporation will be the dominant process contributing to the fate of spilled diesel from the sea surface and will account for 60–80% reduction of the net hydrocarbon balance
- The evaporation rate of diesel will increase in warmer air and sea temperatures
- Diesel 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.

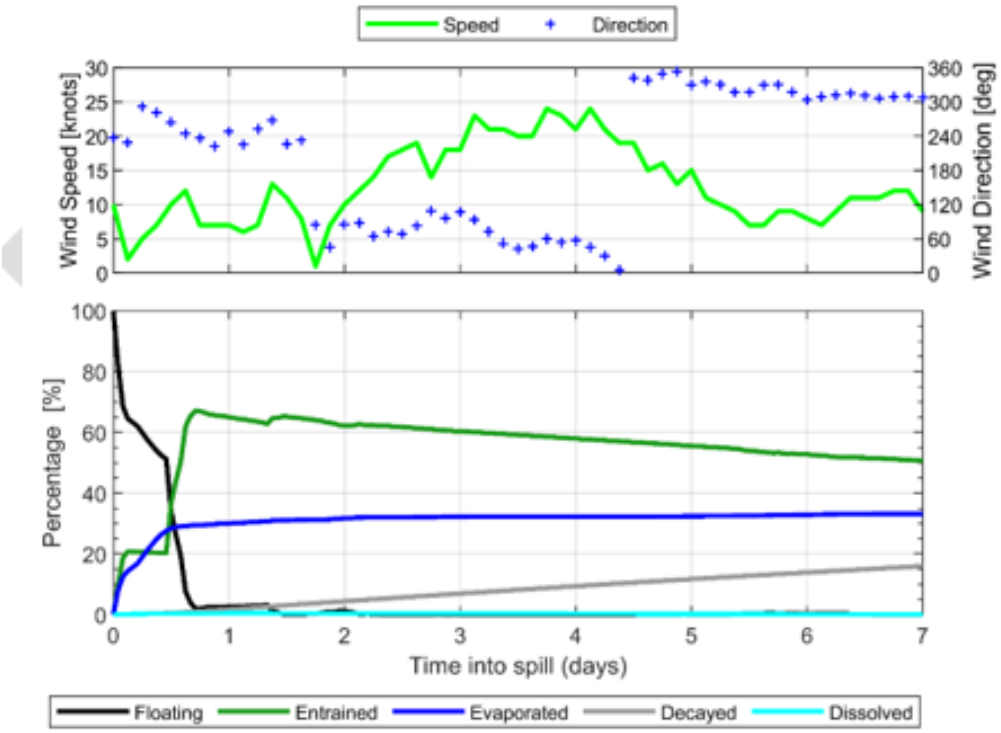
Modelling of surface diesel spills by RPS (2024) indicates that at least 36.1% by volume would evaporate within 24 hours of release under calm conditions (Figure 7-3). The remaining diesel would mostly remain on the surface, where it would be subject to continuing weathering including evaporation and photo-oxidation, although at a slowed rate (RPS, 2024). Almost no diesel in this scenario is predicted to become entrained.

For the variable weather simulation (Figure 7-4), after 24 hours, 30% of the mass would evaporate, while 65% was expected to have entrained. Approximately, 2.6% of floating oil remains on the water surface. The low volatile and residual compounds are anticipated to entrain beneath the surface under conditions that generate wind waves (> ~12 knots). While the MDO is entrained, it is forecast to decay at a higher rate of 2.3% per day or 16% after 7 days, attributed to biological and photochemical degradation. This contrasts with a rate of 0.4% per day and a total of ~2.8% after 7 days for the constant-wind case. Given the proportion of entrained MDO and its tendency to remain mixed in the water column, the remaining hydrocarbons are expected to undergo decay over several weeks. Further detailed information on the receptors can also be found in Appendix C.



Source: APASA (2014).

Figure 7-3: Proportional mass balance plot representing the weathering of marine diesel spilled onto the surface as a once-off release (50 m^3 over 1 hour) and subject to a constant 5-knot (2.6 m/s) wind, currents at 27 °C water temperature



Source: APASA (2014).

Figure 7-4: Proportional mass balance plot representing the weathering of marine diesel spilled onto the surface as a once-off release (50 m^3 over 1 hour) and subject to variable wind speeds of 2–23 knots (1–12 m/s), currents and 27 °C water temperature

Given the proportion of entrained MDO and its tendency to remain mixed in the water column, the remaining hydrocarbons are expected to undergo decay over several weeks. The intertidal and shoreline habitats at receptors within the EMBA and the sensitivities of these receptors to hydrocarbons are provided in the condensate risk assessment section in Table 7-14. Further detailed information on the receptors can also be found in Section 3.

The modelling results are presented below for the fate of hydrocarbons (floating, entrained, dissolved and accumulated) at the exposure values described in Section 7.6.5. Table 7-18 has been provided for the purposes of risk evaluation and displaying the following parameters:

- Minimum time to contact from moderate and high exposure value
- Maximum hydrocarbon concentration from high exposure value
- Maximum oil loading on shoreline from moderate and high exposure value
- Length of shoreline oiled.

Further parameters required to inform spill response strategies are described further in the OPEP.

Floating oil – Commonwealth/State Water boundary

Low

Stochastic modelling determined that floating oil at the low exposure value is expected to reach up to 36 km from the spill site at concentration of 1 g/m^2. The maximum probability of contact is at the Dampier Archipelago at 0.67%. No other EVAs are expected to be contacted at the low exposure value.

Moderate

Stochastic modelling determined that floating oil at the moderate exposure value of 10 g/m^2 may reach only 25 km from the spill site. No EVAs are expected to be contacted at the moderate exposure value for floating hydrocarbons.

High

Stochastic modelling determined that floating oil at the high exposure value of 50 g/m^2 may reach only 12 km from the spill site. No EVAs are expected to be contacted at the high exposure value for floating hydrocarbons.

Shoreline accumulation – Commonwealth/State water boundary

Low

There is a 9.33% probability of shoreline accumulation at the low exposure value at Montebello Islands, 6% probability of accumulation at Lowendal Islands, 4.33% probability at Barrow Island and 1.67% probability at Dampier Archipelago.

Moderate

There is a 1.33% probability of shoreline accumulation at this exposure value at Montebello Islands and Lowendal Islands. There is a 0.67% probability of shoreline accumulation at Dampier Archipelago and 0.33% probability at Barrow Island. The maximum accumulated volume at any receptor is 24m^3.

High

There is no probability of contact at any HEV above the high exposure value.

Dissolved oil – Commonwealth/State water boundary

Low

Stochastic modelling determined that dissolved oil at the low exposure value of 10 ppb is expected to reach 125 km from the spill site. Barrow-Montebello Surrounds, Lowendal Islands and Montebello Islands all recorded the highest probability of exposure (0.67%) at, or above, the 10 ppb threshold.

Moderate

Stochastic modelling determined that entrained oil at the moderate exposure value of 50 ppb is expected to reach 53 km from the spill site. No EVAs are expected to be contacted at the moderate exposure value for dissolved hydrocarbons.

High

Stochastic modelling determined that there will be no dispersal of dissolved oil at the high exposure value of 400 ppb from the spill site. Therefore, no EVAs are expected to be contacted at the high exposure value for dissolved hydrocarbons.

Entrained oil – Commonwealth/State water boundary

Low

Stochastic modelling determined that entrained oil at the low exposure value of 1,000 ppb may reach up to 36 km from the spill site. No EVAs are predicted to be exposed to entrained hydrocarbons at, or above, the 1,000 ppb threshold.

Floating oil – HDD crossing

Low

Stochastic modelling determined that floating oil at the low exposure value is expected to reach up to 19 km from the spill site at concentrations of 1 g/m^2. No sensitive receptors are expected to be contacted at the low exposure value for floating hydrocarbons.

Moderate

Stochastic modelling determined that floating oil at the moderate exposure value of 10 g/m^2 may reach only 15 km from the spill site. No sensitive receptors are expected to be contacted at the moderate exposure value for floating hydrocarbons.

High

Stochastic modelling determined that floating oil at the high exposure value of 50 g/m^2 may reach only 8 km from the spill site. No sensitive receptors are expected to be contacted at the high exposure value for floating hydrocarbons.

Shoreline accumulation HDD crossing

Shoreline accumulation is expected to occur at a number of receptors within the EMBA with the maximum volume expected to be 199 m^3 and this occurs at the Northern Islands Coast. Specific details of shoreline accumulation is provided below in the context of the low, moderate and high exposure values.

Low

There is a 47.67% probability of shoreline accumulation at this exposure value at Northern Islands Coast, 25% probability of contact at Dampier Archipelago and 0.33% probability at Middle Islands Coast.

Moderate

There is a 28% probability of contact at this exposure value at Northern Islands Coast and 5.33% probability of contact at Dampier Archipelago.

High

There is a 14.67% probability of contact at this exposure value at Northern Islands Coast.

Dissolved oil – HDD crossing

Low

Stochastic modelling determined that dissolved oil at the low exposure value of 10 ppb is expected to reach up to 19 km from the spill site. No sensitive receptors are expected to be contacted at the low exposure value for dissolved hydrocarbons.

Moderate

Stochastic modelling determined that dissolved oil at the low exposure value of 50 ppb is expected to reach 10 km from the spill site. No sensitive receptors are expected to be contacted at the moderate exposure value for dissolved hydrocarbons.

High

Stochastic modelling determined that there will be no dispersal of dissolved oil at the high exposure value of 400 ppb from the spill site. Therefore, no sensitive receptors are expected to be contacted at the high exposure value for dissolved hydrocarbons.

Entrained oil – HDD crossing

Low

Stochastic modelling determined that entrained oil at the low exposure value of 1,000 ppb may reach up to 18 km from the spill site. No sensitive receptors are expected to be contacted at the low exposure value for entrained hydrocarbons.

Table 7-18: Modelling results for surface release of diesel at the CSB or HDD crossing

Receptor	Receptor Type	Minimum time to contact (hours)							Maximum Hydrocarbon Concentration					Max. local accumulated concentration	Max. accumulated volume (m^3)	Max. length of shoreline (km)
		Moderate exposure values				High exposure values			Moderate exposure values			High exposure values				
		Shoreline accumulation 100 g/m^2	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbon (1000 ppb)	Shoreline accumulation (1000 g/m^2)	Surface hydrocarbons (50 g/m^2)	Dissolved hydrocarbons (400 ppb)	Surface hydrocarbons (10 g/m^2)	Dissolved hydrocarbons (50 ppb)	Entrained hydrocarbon (1000 ppb)	Surface hydrocarbons (50 g/m^2)	Dissolved hydrocarbons (400 ppb)	Shoreline accumulation g/m^2	Shoreline accumulation >100g/m^2	Shoreline accumulation >100g/m^2
Surface release of diesel – CSB Location																
Barrow Island	Emergent	343	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	322	4	1
Dampier Archipelago	Emergent	58	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	906	21	5
Lowendal Islands	Emergent	133	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	167	4	2
Montebello Islands	Emergent	139	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	177	5	3
Surface release of diesel – HDD Crossing Location																
Dampier Archipelago	Emergent	115	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	355	7	3
Northern Islands Coast	Emergent	2	NC	NC	NC	3	NC	NC	NC	NC	NC	NC	NC	14,731	199	11

NC= No Contact

7.8.3 Environmental performance objectives and control measures

The EPO relating to this event:

- No loss of containment of hydrocarbon to the marine environment [EPO-DC-08].

Control measures applied to prevent an oil spill are shown in Table 7-19, and corresponding EPSs and measurement criteria for the EPOs described in Table 8-2.

Selection of oil spill response strategies and associated EPOs, control measures and EPSs, including those required to maintain preparedness and for response, are detailed within the OPEP. The OPEP contains an evaluation of oil spill preparedness arrangements to demonstrate that oil spills will be mitigated to ALARP.

Table 7-19: Control measures evaluation for surface release of diesel (vessel collision/bunkering)

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-05	Vessel planned maintenance system	Administrative	Ensure vessel is running efficiently and routine maintenance endeavours to ensure risk of collision form vessel system failure is reduced.	No additional costs, is industry best practice.	**Adopted** – No additional costs.
DC-CM-06	Navigation lighting and aids.	Administrative	Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled and other marine users are aware of the presence of the WHP and vessels.	Costs of operating and maintaining navigational equipment.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-09	Fuel oil quality.	Administrative	Ensure vessels are operating as per Australian standards and HFO/IFO is not in use.	No additional costs, as this is a regulatory requirement.	**Adopted** – no additional costs.
DC-CM-15	Navigational charting of infrastructure.	Administrative	Provides a means for marine users to be aware of the presence of the subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-16	Seafarer Certification.	Administrative	Requires appropriately trained and competent personnel, in accordance with Marine Order 70, to navigate vessels to reduce interaction with other marine users.	Costs associated with personnel time in obtaining qualifications.	**Adopted** – Benefits considered to outweigh costs and it is a legislated requirement.

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-22	Marine Assurance Standard.	Administrative	Ensures vessels meet Marine assurance standards to reduce the likelihood of unplanned discharge.	Costs associated with personnel time in checking vessel.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
DC-CM-30	Vessel spill response plan (SOPEP/SMPEP).	Administrative	Implements response plans on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently in order 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 is in place.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-35	Santos Refuelling and Chemical Transfer Standard (SO-91-IQ-00098	Administrative	Minimises risk of pollution to ALARP during hydrocarbon transfers/ vessel refuelling.	Personnel costs associated with ensuring procedures are in place and implemented during refuelling and chemical transfers.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.
DC-CM-43	Accepted oil pollution emergency plan (OPEP).	Administrative	Implements response plan to deal with an unplanned hydrocarbon spills quickly and efficiently in order 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** – Benefits of ensuring procedures are followed and control measures implemented outweigh costs to Santos.
Additional Control Measures					
N/A	Dedicated resources (e.g. dedicated spill response facilities on location) in the event of loss of hydrocarbons to allow rapid response.	Administrative	May allow for quicker response to a spill as resources will be within close proximity.	Large costs associated with a dedicated resource on location.	**Rejected** – Large cost associated with dedicated resources on location deemed grossly disproportionate compared to low risk of large MDO spill and subsequent rapid dispersion and evaporation.

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
N/A	Require all support vessels involved in the activity to be double hulled.	Protective	Reduces the likelihood of a loss of hydrocarbon inventory in the highly unlikely event of a vessel collision, minimising potential environmental impact.	Vessels are subject to availability and are required to meet Santos' standards during activities; requirement of a double hull on vessels would limit the number available to Santos; requiring vessels to be refitted to ensure double hulls would also be of high cost.	**Rejected** – Large costs associated with vessel selection and by having an activity schedule determined by vessel availability deemed grossly disproportionate compared to low risk of a vessel collision and low risk of a large diesel spill.
N/A	Add additional warnings and/or lights to attract attention	Engineering	Potential reduction in risk of collisions	As per DC-CM-06, vessels shall comply with Marine Order Part 30: Prevention of Collisions, and with Marine Order Part 21: Safety of Navigation and Emergency Procedures. Additional warnings and/or lighting would require retrofitting vessels, requiring additional financial and logistics costs, disproportionate to any environmental benefit.	**Rejected** – Cost is disproportionate to increase in environmental benefit.
N/A	Offshore guard vessel/s that can monitor traffic, and take early action to alert a vessel approaching the area of operations	Administrative	Potential reduction in risk of collisions	Significant extra costs associated with procuring a guard vessel, for negligible reduction in collision risk. An additional vessel may also introduce safety and environment risks.	**Rejected** – Cost is disproportionate to increase in environmental benefit.

7.8.4 Environmental impact assessment

The below environmental impact assessment follows the risk assessment approach detailed in Section 7.6.5.

7.8.4.1 Identification of hotspots for consequence assessment

As described in Section 7.6.6, all HEV's within the EMBA (low exposure threshold) are listed in Table 7-20 below. The values and sensitivities associated with these HEVs have been described in Appendix C. Further to this, Table 7-20 filters the HEV to identify the hotspots where they meet the criteria in Table 7-20, also described in Section 7.6.6:

Table 7-20: Identified high environmental value and hotspot receptors

Receptor	HEV Value	Exposure Value			Hotspot
		Low	Moderate	High	
Vessel Collision at CSB					
Barrow Island	3	✓	✓		✓
Barrow-Montebello Surrounds	3	✓			
Dampier Archipelago	4	✓	✓		✓
Lowendal Islands	3	✓	✓		✓
Montebello AMP	4	✓			
Montebello Islands	3	✓	✓		✓
Vessel Collision at HDD Crossing					
Dampier Archipelago	4	✓	✓		✓
Middle Islands Coast	4	✓			
Northern Islands Coast	3	✓	✓	✓	✓

This process identified the following hotspots and rationale for their selection are shown below.

Table 7-21: Determination and rationale for the hotspots

Hotspots	Type	HEV Ranking	Hotspot	Rationale
Vessel Collision at CSB				
Barrow Island	Emergent	3	Yes - Discretionary	Discretionary: Does not meet default criteria as <5% probability (4.33% probability of shoreline oil at low threshold). Shoreline accumulation also <5% probability but there is 4m^3 shoreline accumulation predicted.
Lowendal Islands	Emergent	3	Yes	Meets standard criteria: HEV = 3 and shoreline accumulation >5% probability at low threshold. Max accumulated volume 4m^3
Montebello Islands	Emergent	3	Yes	Meets standard criteria: HEV = 3 and shoreline accumulation >5% probability at low threshold. Max accumulated volume 5m^3
Dampier Archipelago	Emergent	4	Yes - Discretionary	Discretionary: Does not meet default criteria as an HEV of 4 and <5% probability of shoreline oil. However, has the greatest volume of shoreline accumulation >100g/m^2 (21m^3)
Vessel Collision at HDD Crossing				
Dampier Archipelago	Emergent	4	Yes - Discretionary	Discretionary: HEV = 4, but shoreline accumulation >5% probability at low and moderate threshold. Max accumulated volume >100g/m2 = 7m^3
Northern Islands Coast	Emergent	3	Yes	Meets standard criteria: HEV = 3 and shoreline accumulation >5% probability at low, moderate and high threshold. Max accumulated volume 199m^3

Table 7-22 provides a simplified summary of the consequence assessment results for each of the Hotspot areas. The consequence assessment was based on predicted contact and concentration of floating oil, accumulated oil, entrained oil and dissolved hydrocarbons. For each Hotspot area the consequence to the key values were assessed using the methodology described in Section 5.

Table 7-22: Hotspot consequence analysis

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
Barrow Island (emergent)		Habitats • Bandicoot Bay – conservation area Fisheries Act (benthic fauna/seabird protection), mudflats, rock platforms, mangroves, clay pans • Mangroves in Bandicoot Bay (considered globally unique) • Coral reefs (eastern side) – Biggada Reef (coral spawning: Mar and Oct) • Biggada Creek Turtles • Regionally and nationally significant green turtle (western side) and flatback turtle (eastern side) nesting beaches • Turtle Bay north beach • North and west coasts – John Wayne Beach also loggerhead and hawksbill turtles. • Peak turtle nesting periods – Loggerhead turtle nesting: Dec–Jan; green turtle nesting: Nov–Apr, peak period from Jan–Feb; flatback turtle nesting: Dec–Jan; hawksbill turtle nesting: Oct–Jan Seabirds • Migratory birds (important habitat) (important bird area) 10th of top 147 bird sites. • Highest population of migratory birds in Barrow Island Nature Reserve (south-southeast island). • Double island important bird nesting (shearwaters, sea eagles). Marine mammals • Pygmy blue whale northern migration (Apr–Aug)	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• II • II • II • II	II
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NC	NC			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	4	NC			
			Maximum accumulated concentration	(g/m^2)	322	NC			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	1	NC			
			Maximum concentration of entrained oil	(ppb)	NC	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NA	NC			
			Maximum concentration of dissolved hydrocarbons	(ppb)	NC	NC			
			Minimum time to contact by dissolved oil ≥50 ppb	Time (h)	NA	NC			

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
		• Cultural heritage • Important Aboriginal cultural: 13 listed sites incl. (pearling camps) Socio-economic • Significant for recreational fishing and charter boat tourism • Nominated place (national heritage)							
Lowendal Islands (Emergent)	3	Habitats • Important shallow lagoons with seagrass for dugongs • Deep-water benthic (soft-sediment) habitats • Dugong Reef and Batman Reef (eastern side Island) • Mangroves are considered globally unique as they are offshore • Macroalgal reefs (40%) Turtles • Important hawksbill (Beacon, Parakeelya, Kaia and Pipeline), loggerhead and green turtle nesting (minor) Varanus pipeline, Harriet and Andersons Beaches) • Nesting is reported to occur throughout the year in WA, peaking between October and January • Significant flatback rookery, nesting season for flatback turtles peaks in December and January with subsequent peak hatchling emergence in February and March Seabirds • Approximately 89 species of avifauna, 12–14 species of migratory and threatened seabirds Marine mammals	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• III • III • III • III	III
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NA	NC			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	4	NC			
			Maximum accumulated concentration	(g/m^2)	197	NC			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	2	NC			
			Maximum concentration of entrained oil	(ppb)	NC	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NA	NC			
			Maximum concentration of dissolved hydrocarbons	(ppb)	18	NC			
			Minimum time to contact by	Time (h)	NC	NC			

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
		• Seagrass beds around the Lowendal Islands thought to provide valuable food source for dugongs Protected Areas • The Barrow Island Marine Management Area, most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park Socio-economic and heritage values • Social amenities and other tourism, very significant for recreational fishing and charter boat tourism	dissolved oil ≥50 ppb						
Montebello Islands (Emergent)	3	Habitats • Reefs – coral spawning: Mar and Oct • Algae (40%) • Mangroves (considered globally unique as they are offshore) • Fish habitat • Intertidal sand flat communities Turtles • Loggerhead and green (significant rookery), hawksbill, flatback turtles – Loggerhead turtle nesting: Dec–Jan; green turtle nesting: Nov–Apr, peak period from Jan–Feb; flatback turtle nesting: Dec–Jan; hawksbill turtle nesting: Oct–Jan • Northwest and Eastern Trimouille Islands (hawksbill) • Western Reef and Southern Bay at Northwest Island (green) Seabirds • Migratory and threatened seabirds – 14 species • Significant nesting (Sep–Feb), foraging and resting areas	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• III • III • III • III	III
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NA	NC			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	3	NC			
			Maximum accumulated concentration	(g/m^2)	177	NC			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	3	NC			
			Maximum concentration of entrained oil	(ppb)	NC	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NA	NC			
			Maximum concentration of	(ppb)	22	NC			

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
		Whales • Humpback (Jun–Jul), pygmy blue (Apr–Aug) whale migration Socio-economic • Pearling (inactive/pearling zones) • Very significant for recreational fishing and charter boat tourism Social amenities and other tourism • Nominated place (national heritage)	dissolved hydrocarbons						
			Minimum time to contact by dissolved oil ≥50 ppb	Time (h)	NC	NC			
Dampier Archipelago	4	Physical Habitats • Coral reefs • Seagrass • Macroalgae • Mangroves Marine Fauna • Invertebrates • Finfish and Rays • high fish biodiversity approx. 650 species, dwarf sawfish EPBC protected • Birds • Marine reptiles Turtles • Flatbacks – nest on Legendre, Hauy, Delambre • Green – significant rookery in NWS • Olive Ridley – known to forage • Loggerhead – nesting and foraging • Seasnakes Marine mammals • Eight species (dugong, whales, dolphins)	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• II • II • II • II • (for both locations)	II
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NC	NC			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	21	7			
			Maximum accumulated concentration	(g/m^2)	906	355			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	5	3			
			Maximum concentration of entrained oil	(ppb)	NC	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NA	NC			
			Maximum concentration of dissolved hydrocarbons	(ppb)	11	NC			

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
		• migratory pathway for protected humpback whale in July-Sept. • Protected Area • Commonwealth Marine Reserve Socio-economic and heritage values • National Heritage Listed • Aboriginal rock art on shorelines, Burrup Peninsula	Minimum time to contact by dissolved oil ≥50 ppb	Time (h)	NC	NC			
Northern Islands Coast	3	Habitats • Reefs • Great Sandy Islands Nature Reserve • Algae • Fish habitat Seabirds • Behavioural BIAs for fairy tern, roseate tern and wedge-tailed shearwater Turtles • Behavioural BIAs for flatback, green and hawksbill turtles Whales • Humpback (Jun–Jul) Socio-economic • Commercial fisheries • Significant recreational fishing Heritage values • Dampier archipelago (including Burrup Peninsula)	Probability of contact by floating oil at ≥10 g/m^2	(%)	NC	NC	• Threatened/migratory fauna • physical habitat • protected areas • socio-economic receptors	• II • II • II • II	II
			Minimum time to contact by floating oil at ≥10 g/m^2	Time (h)	NC	NC			
			Maximum accumulated oil on shoreline >100g/m^2	(tonnes)	NC	199			
			Maximum accumulated concentration	(g/m^2)	NC	14,731			
			Maximum length of shoreline oiled (≥100 g/m^2)	(km)	NC	11			
			Maximum concentration of entrained oil	(ppb)	NC	NC			
			Minimum time to contact by entrained oil ≥1000 ppb	Time (h)	NC	NA			
			Maximum concentration of dissolved hydrocarbons	(ppb)	NC	NC			

Receptor name	HEV ranking	Values	Oil spill modelling parameter		CSB location	HDD Location	Consequence category	Worst-case consequence ranking	Total
			Minimum time to contact by dissolved oil ≥50 ppb	Time (h)	NC	NA			

325 m^3 of Marine Gas Oil over 1 hour from a Vessel to Vessel Collision at the HDD Crossing or CSB	
Receptors	Threatened, migratory or local fauna Protected areas Physical environment or habitats Socio-economic receptors
Pre-treatment Consequence	IV– Major at both CSB and HDD Crossing locations
Consequence	III – Moderate at both CSB and HDD Crossing locations
Accumulation above 100 g/m^2 is expected with moderate shoreline-accumulated hydrocarbons (21 m^3) in the CSB location but as high as 199 m^3 at the HDD crossing location. The susceptibility of marine fauna to hydrocarbons depends on hydrocarbon type and exposure duration. Given exposures would be limited in extent and duration, exposure to marine fauna from this event is not expected to result in a fatality. Habitat modification, degradation, disruption or loss, deteriorating water quality, and marine pollution are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice (Table 3-9). In the unlikely event of a vessel collision, dropped object or bunkering spill of marine diesel, the potential impacts to the environment would be greatest within a few kilometres from the spill when the toxic aromatic components of the fuel will be at their highest concentration. Diesel will rapidly lose toxicity with time and will spread thinner as evaporation continues. Tourism could be affected by spilled diesel, either from reduced water quality or shoreline oiling preventing recreational activities or reducing aesthetic appeal or from impacts to habitats and marine fauna. Marine habitats may also be impacted by moderate volumes of diesel (worst case, 199 m^3 above 100 g/m^3) potentially accumulating on shorelines. Indigenous users may be impacted in the event that a land-based response is required. However, consultation will help manage activities such that potential impacts are reduced to acceptable levels. On the basis of the above assessments, a surface diesel release at Commonwealth–State waters boundary or HDD crossing has the potential to impact receptors in the water column and shorelines at a number of locations. The worst-case consequence is considered to be III-Moderate based on a vessel collision scenario occurring and affecting Lowendal Islands or Montebello Islands. It is noted that the consequence from a bunkering spill is considered to be I-Negligible given the smaller area of potential impact.	
Likelihood	a – Remote
Det Norske Veritas (DNV) published a report in 2011 for AMSA which assessed the risk of pollution from marine oil spills in Australian ports and waters. This report found that, based on vessel activity in 2010, there is a high frequency of spills greater than 100 tonnes within the operational area (DNV, 2011). Whereby high is defined as 0.01 to 0.1 events every year. This likelihood can be applied to the potential for the two vessel collision scenarios described in this EP and therefore the worst-case diesel spill scenario (DNV, 2011). Assuming a worst-case frequency of 0.1 events every year (DNV classification of high likelihood), this is classified as likely (4) (i.e. up to a frequency of 10^{-1}/year) under the Santos matrix (Table 5-4). The consequence (assessed above) of moderate, results in a Very Low risk. The DNV report also states that spills greater than 1 tonne, but less than 100 tonnes, have a likelihood of very high (> 0.1 events every year) within the operational area (DNV, 2011) which would cover smaller spills from bunkering during the activity. Noting that the area covered by the report also covers at least one port, where bunkering spills are considered higher. Assuming a worst-case frequency of >0.1 events every year (DNV classification of very high likelihood), this is classified as probable (5) (i.e. up to a frequency of 1/year) under the Santos matrix (Table 5-4). The consequence (assessed above) of Negligible results in a very low risk.	
Residual Risk	The residual risk associated with a vessel collision event is Very Low.
	The residual risk associated with a refuelling event is Very Low.

7.8.5 Demonstration of ALARP

Vessels are equipped with navigation and safety equipment, as required by the International Convention of the Safety of Life at Sea (SOLAS) 1974 and implemented via the *Navigation Act 2012*. Additional industry standards and survey-specific controls (i.e. notifications and watch keepers) to reduce collision risks have also been implemented. There is a very low likelihood of a collision and an even lower likelihood of a fuel tank being ruptured during such a collision.

Refuelling at sea is not expected to occur for planned activities along the pipeline corridor. If refuelling is to occur, an accepted refuelling procedure will be implemented. Vessels will implement safeguards including (but not limited to) dry break refuelling hoses and well-maintained equipment and will have access to spill clean-up equipment. Chemicals and hydrocarbons will be stored safely (i.e. bunding and chemical storage lockers) to reduce the likelihood that a spill will be washed overboard.

Offshore refuelling is standard industry practice and oil pollution legislation including *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and Marine Order 91, have been developed to safeguard against the risk of an unplanned hydrocarbon spill occurring during refuelling.

Given the controls in place detailed above, the assessed residual risk for this impact is low and cannot be reduced further. It is considered therefore that the impact of the activities conducted are reduced to ALARP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the OPEP.

7.8.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – Maximum credible spill volume from vessel collision (325 m^3) residual risk is ranked as Very Low.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, conservation advice and Australian marine park zoning objectives)?	Yes – Management consistent with P(SL)(E) Regulations including safety case and wellhead operations management plan. Santos has considered the values and sensitivities of the receiving environment including, but not limited to: • Conservation values of the identified protection priorities including the Montebello Australian Marine Park, the Barrow Island Marine Park Management Area, Montebello Marine Park, Muiron Island Marine Management Area, Relevant species recovery plans, conservation management plans and management actions set out in Table 3-11
Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos' Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The potential impacts and risks from diesel spills are well understood, and the event will be managed in accordance with relevant legislation and standards. With the implementation of industry standards and activity-specific control measures to reduce the likelihood of a diesel spill event (and minimise impacts), the residual risk is assessed to be *Very Low* and ALARP. No stakeholder concerns have been raised regarding this hazard. Therefore, it is considered that the proposed control measures will reduce the risk of impact from a diesel spill to a level that is acceptable.

7.9 Onshore release of hydrocarbon from the DC supply pipeline

7.9.1 Description of event

Event	There is the potential for a leak or rupture of the buried section of the DC supply pipeline between the shoreline and the boundary of the DCGP or from the DC sales gas pipeline between lease boundary of the DCGP to the Dampier Bunbury National Gas Pipeline (DBNGP) which is approximately 40 m underground and only contains dry sales with no condensate) The worst-case credible spill is a release of 121.4 m^3 of Reindeer condensate from the DC supply pipeline.
Extent	The onshore section of the DC supply pipeline to the DCGP, and from the DCGP to the DBNGP is below ground; therefore, it is unlikely that there will be any surface expression of condensate, given the relatively low rate of condensate flowing in the bottom section of the DC supply pipeline and the porosity of the sediments. The minimum depth of the DC supply pipeline is 1200 mm. The inferred groundwater flows indicate a likely hydraulic gradient flowing from southeast to northwest (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west. In 2007, groundwater levels below DCGP prior to construction activities ranged from 9.7 to 10.7 m. Any condensate (e.g. methane) within the pipeline would leak as bubbles in the immediate vicinity of the leak.
Duration	14.6 hours

7.9.2 Nature and scale of environmental impacts

The onshore spill scenario maximum credible spill relates to the release of 121.4 m^3 of hydrocarbon due to a rupture of the DC supply pipeline. (11.1 km, from Gnoorea Point to the gas plant boundary). The minimum depth of the DC supply pipeline is 1200 mm below the surface along 40 Mile Beach Road Reserve, adjacent to Mardie and Karratha stations pastoral leases.

The relevant environmental settings, values and sensitivities potentially exposed to an onshore pipeline spill are detailed in Table 7-23.

Table 7-23: Onshore environmental features and sensitivities

Feature/Element	Description of the Feature/Element
Site Features	
Landforms or topography	The topography of the areas generally shows a gradual fall in elevation, from the 20 m above height datum elevation from the gas plant location (south east) towards the Indian Ocean (about 11 km to northwest of the plant).
Surface water	The nearest surface water is Devil Creek, an ephemeral creek located about 200 m to the east of the pipeline alignment. This creek drains to the north. The topography of the pipeline section close to the gas plant site does not appear to allow natural drainage of surface water to the creek, as the majority of the site slopes towards the north.
Soil profile	The typical subsurface profile in the area closer to the gas plant is mainly made up of clayey silt to sandy clayey silt on the top layer (0–1.8 m). Layers beneath are made up of conglomerates (1.8–4.1 m) and calcarenite limestone (1.8 m to more than 8 m). The profile varies for sections along the pipeline route along 40 Mile Beach Road. Based on geotechnical data, two distinct conditions were reported. For the sections closer towards the shoreline, the subsurface profile comprised silty sand overlying calcarenite rock containing some calcrete layers. The remaining section of the route towards the plant site comprises varying profile, generally including silty sand, clayey sand and clayey silt, silty clay and gravelly clay, and many other composition combinations. In several locations, the test pit met refusal on rock above the target depth. Perched groundwater tables on silty and clayey soils may occur following periods of rainfall. The above profiles were based on the pre-construction surveys. Note that for the installation, the layer above the top of the pipe has been replaced with compacted sand fill material, with most of the excavated spoil reused as backfill.
Groundwater hydraulic gradient and quality	Groundwater quality is expected to be mostly freshwater or brackish, limiting potential beneficial use to mainly irrigation or industrial processes, but drinking water will require desalination. Subsurface groundwater flows are considered to most likely have a hydraulic gradient flowing from east to west (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west. In 2007, groundwater levels below DCGP prior to construction activities ranged from 9.7 to 10.7 m.
Vegetation and flora	There are no threatened ecological communities, threatened flora or priority flora within the operational area. There are two priority ecological communities which are identified as being within large areas around the operational area including small portions that overlap the operational area. The vegetation along the operational area was cleared during the construction of the pipeline and rehabilitated in accordance with

Feature/Element	Description of the Feature/Element
	MS 795. However, since rehabilitation, the OEPA have inspected the area and concluded that the quality of vegetation within the rehabilitated areas is poor due to factors outside Santos control, such as public access along the adjacent road.

Potential receptors: Flora, fauna and socio-economic

The vegetation in the area has been disturbed by activities which occurred prior to the pipeline operations. Weed proliferation (particularly Buffel grass) is common and no species of ecological significance is present in the area. The condition of the vegetation is influenced by the seasons and, although controlled, weed proliferation still occurs and reduces native species cover and diversity. This is also attributed to external factors, such as public vehicle, road maintenance and livestock activities, causing continuous disturbance.

A sparse mangrove (*Avicennia marina*) stand on the west side of Gnoorea Point, exists adjacent to the operational area (pipeline shore crossing) exists within the EMBA.

Fauna of ecological significance in the area are mainly associated within the shoreline location where the mangroves occur (most abundant on the western face of Gnoorea Point) or sandy beach areas adjacent to the pipeline.

These include the 54 vertebrate fauna of conservation significance expected to be found in the area. The majority are birds likely to be found in the intertidal zone or mangroves areas. However, protected fauna includes mammals (including the northern quoll and greater bilby) and reptiles (including turtles).

Stygofauna which belong to the freshwater aquatic 'subterraneous' ecosystem (not high conservation significance in the context of its occurrence in the area) have been found in the groundwater system.

The area along the beach adjacent to the pipeline close to the shoreline at Gnoorea Point is a camping site with a boat ramp. The 40 Mile Beach Road adjacent and parallel to the onshore pipeline route is the main access to the 40 Mile Beach.

40 Mile Beach Road pipeline reserve is adjacent to Mardie and Karratha stations pastoral leases. Livestock may be exposed in the event of a spill.

A significant sensitivity includes a groundwater bore (Boundary Well) located less than 200 m from the pipeline. Based on the data search available from the Department of Water's Groundwater Bore Database (WIN), it is possible that the bore water can be used for livestock purpose, however, unable to verify if the data is current.

In the instance of a pipeline leak there may be bubbling of gas to the surface, however this is unlikely based on the depth of the pipeline below the surface. This would be localised to the immediate vicinity of the leak and is not likely to be in large volumes. It would mix with the air and become diluted as soon as it reached the surface. On this basis there are not expected to be any impacts to receptors within the area.

7.9.2.1 Predicted effect on soil and the groundwater system

Based on extensively studied spill sites like the pipeline crude oil spill near Bemidji in the US, fundamental knowledge derived pertaining to the fate and transport of hydrocarbon in the subsurface has been applied to the understanding of the soil and groundwater contamination risk of the Devil Creek onshore pipeline spill scenario.

The fate transport and multiphase flow of hydrocarbons depends on geochemical processes and on the processes of volatilization, dissolution, biodegradation, transport and sorption. In the event of a subsurface spill volatile components are expected to leave the subsurface through volatilisation and biodegradation and diffusion through the unsaturated zone. In the case of the case of the Bemidji spill oil that had percolated through the soil is still volatilising creating a soil vapour plume in the saturated zone (Truzkewycz et al., 2019).

Based on the volatile nature of the Reindeer condensate and the sandy silty nature of the soil in the vicinity of the pipeline, there is potential for the aquifer to be impacted in the event of an onshore spill. In the case of the Bemidji spill, even after 16 years, the leading edge of the plume[6] of groundwater containing BTEX had moved only about 200 m down the hydraulic gradient, whereas advective flow of ground water since the spill has been about 500 m.

The primary reason is that hydrocarbons get biodegraded under the natural attenuation process and evidence suggests that the spill reaches equilibrium and stabilises. This condition is likely to be analogous to the Devil Creek onshore pipeline spill scenario, thus affecting limited areas of the aquifer around the spill.

The groundwater dissolved contaminant plume extent is estimated to have the potential to move 200 m from the leak or rupture point to either side of the pipeline within a year. This is under conservative conditions. This Zone of

[6] *Note: This different to the leading edge of the oil floating (free phase oil or light non-aqueous phase liquid) on the water table which had moved 40 m down the hydraulic gradient since the spill. The former refers to the contamination plume that contains concentrations of dissolved constituents such as BTEX. Although the plume migration characteristics are influenced by the actual ground-water flow velocities and sorption constants for these compounds, the behaviour of the plume are expected to be similar.*

Potential Impact was derived based on the modelled estimates provided in a detailed general pipeline spill assessment[7]. The basis for estimating the 200 m extent was the assumption that the soil type is representative of the loamy to sandy soil profiles used in the US study.

7.9.3 Environmental performance objectives and control measures

The EPO relating to this event:

- No loss of containment of hydrocarbon to the terrestrial environment [EPO-DC-09].

Control measures applied to prevent an oil spill are shown in Table 7-24, with EPSs and measurement criteria for the EPOs described in Table 8-2.

Operational controls that would be implemented to guide an effective response after a spill has occurred are provided within relevant sections of the OPEP, together with corresponding EPSs and Measurement Criteria.

Table 7-24: Control measures evaluation for onshore release of reindeer condensate

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-01	Obtain vegetation clearing permit if required.	Administrative	Clearing in accordance with a native vegetation clearing permit will ensure that the impacts have been fully assessed and appropriate control measures are in place.	Cost (time and materials) associated with applying for a native vegetation clearing permit and implementation of associated controls.	**Adopted** – Environmental benefit and legal requirement outweigh potential costs.
DC-CM-39	Emergency response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Administrative	Implements the ESD system quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine and terrestrial environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-42	Testing and maintenance of ESD systems and shutdown or safety valves.	Engineering	Maintenance and testing of emergency systems and shutdown valves enable potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-43	Accepted Oil pollution emergency plan (OPEP).	Administrative	Implements response plan to deal with an unplanned hydrocarbon spill quickly and efficiently in order to reduce impacts to the marine environment.	Personnel and administrative costs associated with preparing documents, ongoing management, (spill response exercises) and implementation of the OPEP.	**Adopted** – Benefits of ensuring procedures are followed and control measures implemented outweigh costs to Santos.
DC-CM-44	DEMIRS accepted safety case.	Administrative	Includes control measures for pipeline integrity and management controls.	Costs associated with personnel time in writing, reviewing and implementing the safety case.	**Adopted** – Benefits considered to outweigh costs. Regulatory requirement must be adopted.

Ref. No	Control Measure (CM)	Hierarchy of control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-45	Inspection and corrosion monitoring.	Engineering	Regular inspections reduce the risk of leaks from pipelines by confirming appropriate integrity.	Costs associated with personnel time in performing the inspections, monitoring and reporting inspections and follow up actions.	**Adopted** – Benefits considered to outweigh costs.
DC-CM-46	Onshore pipeline inspection procedure	Administrative	Inspection includes the discovery of undetected damage noting indication of leaks such as dead vegetation or evidence of liquid ensuring hydrocarbon release location and nature is identified as early as possible.	Administrative costs of preparing documents.	**Adopted** – Environmental benefit and legal requirement outweigh potential costs
Additional Control Measures					
N/A	Dedicated resources (e.g. dedicated spill response facilities on location) in the event of loss of hydrocarbons to allow rapid response.	Administrative	May allow for quicker response to a spill as resources will be within close proximity. Limits extent of potential spills.	Large costs associated with dedicated resources.	**Rejected** – Costs grossly disproportionate to the environmental benefit.

7.9.4 Environmental impact assessment

Receptors	Threatened, migratory or local fauna Protected areas Physical environment or habitats Socio-economic receptors
Pre-treatment Consequence	III - Moderate
Consequence	III - Moderate
Notwithstanding surface expression of the spill at a specific location described above, subsurface risk to soil and the groundwater system is the most likely exposure pathway. The inferred groundwater flows indicate a likely hydraulic gradient flowing from southeast to northwest (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west.	
Likelihood	a – Remote
The onshore section of the DC supply pipeline is below ground; therefore, it is unlikely that there will be any surface expression of condensate, given the relatively low rate of condensate flowing in the bottom section of the DC supply pipeline and the porosity of the sediments. However, the exception to this could be if the spill occurs at the saline flat section. This section has a shallow water table and is subject to inundation after a rainfall or storm event (not tidal influence). Due to the condition, this section of the onshore pipeline section has concrete coating to control the buoyancy forces acting on the pipeline to ensure its integrity at all times. The pipeline section cutting across the saline flats which may flood during rainfall may also be the point where oil can pool, if the rupture occurs up-gradient of this point; i.e. from southeast towards the northwest direction of the pipeline route. Depending on where the rupture occurs, the rate the oil percolates down through the subsurface layers before reaching the groundwater table may vary significantly due to the varying water tables and soil profiles. The groundwater table in the vicinity of the pipeline section closer to the gas plant location will likely be contacted much later due to the deep water table levels (10.9 m to 15.1 m above height datum) in the area. This will contrast significantly when compared to the sections of the pipeline towards the shoreline, particularly at the saline flats area, where the depths are shallower, therefore resulting in a faster contact time.	

Residual Risk	The residual risk associated with this event is Very Low.

7.9.5 Demonstration of ALARP

Since the transfer of condensate and gas to DCGP processing facilities is an integral part of operational activities, the risk of a condensate spill from a pipeline cannot be completely eliminated along the length of the pipeline. Several procedural controls are in place, which reduce the likelihood of these events.

The integrity of the pipeline is maintained through planned inspection, monitoring and testing of its components, ensuring the system operates within its design requirements and there is no unacceptable degradation of the system (e.g. materials or ESD valve shutdown time or leakage). Concrete coating has also been applied to the length of the pipeline for primary stabilisation. Furthermore, an external anti-corrosion coating has been applied and sacrificial anodes are used to prevent external corrosion.

The primary mechanism to immediately respond to a release of hydrocarbon from the onshore pipeline is via the emergency shutdown system managed through the Devil Creek Incident Response Plan (DC-40-IF-00096). This system responds to both automatic and manual activation, with automatic activation triggered by abnormal process conditions, such as pressure drop across the subsea production system. The emergency shutdown system functionality and reliability is maintained through regular testing of the shutdown systems and the subsea valves. The regular testing and maintenance of the emergency shutdown and blowdown systems are managed through Performance Standard Assurance Plans (PSAPs), which provide the work instructions and performance criteria to test and service the shutdown and blowdown systems against. The relevant PSAPs contain specific performance criteria as detailed below:

- PS-06 ESD and Blowdown: Emergency Shutdown Valves (ESDVs) (DC-00-RG-00027). The performance criteria specified in PS-06 includes:
  - Appropriate ESDV location, ESDV close on demand timings, process safety time calculation, acceptable leak rates of the ESDV (as per American Petroleum Institute), ESDV signage, ESDV alarm, leakage testing, position testing alarms.
- PS-08 ESD and Blowdown: Safety Instrumented Systems (DC-00-RG-00029). The performance criteria for Safety instrumented Systems in PS-08 includes:
  - ESD pushbuttons, status of SIS elements display requirements, reliability/availability achievement and testing requirements, logic Solver location requirements electrical tripping device.

The relevant PSAPs are listed as control measures with relevant performance standards in Table 8-2. These performance standards are not applicable once the hydrocarbon has been removed/flushed from the pipeline.

The maintenance and regular testing of the shutdown systems managed through the PSAPs ensures available, reliable, survivable and independent control ensuring the emergency shutdown and blowdown functionality, resulting in near-instantaneous shut in following loss of pressure, and is considered to reduce the spill volume to ALARP for an unplanned release of condensate from the DC supply pipeline.

In terms of spill response activities, Santos will implement oil spill response as specified within the OPEP. A detailed ALARP assessment on the adequacy of arrangements available to support spill response strategies and control measures is presented in the OPEP.

7.9.6 Acceptability evaluation

Is the risk ranked between very Low to Medium?	Yes – Hydrocarbon spill residual risks are ranked *Very Low*.
Is further information required in the consequence assessment?	Yes – Hydrocarbon spill modelling results have been used to determine consequence and risk.
Is the petroleum activity conducted, including assessment of hazards, consistent with the principles of ecologically sustainable development?	Yes – Activity has been evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers the principles of ecologically sustainable development.
Are performance standards consistent with industry standards, legal and regulatory requirements, including protected matters, recovery plans, management plans and conservation advice?	Yes – Management consistent with DWER licence, EPBC Act and the *Contaminated Sites Act.*
Are performance standards consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are performance standards consistent with stakeholder expectations?	Yes – No concerns raised.

Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The likelihood of an onshore condensate release from a pipeline is remote when considering industry statistics, Santos statistics and the preventive controls in place. Additional industry standard and activity-specific control measures to reduce the chance of the event occurring (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the safety case, personnel training and awareness, and a spill response plan (the OPEP). In accordance with Santos' risk assessment process, the residual risk is considered to be very low and ALARP. The proposed control measures will reduce the risk of impacts from a onshore pipeline condensate release to a level that is considered acceptable.

7.10 Unplanned release of treated seawater

7.10.1 Description of event

Event	Once the DC supply pipeline reaches the end of field life it will need to be flushed of hydrocarbons and preserved for future decommissioning or other uses. Following flushing of the pipeline to DCGP, the pipeline will be filled with treated seawater. Following flushing the pipeline may be re-preserved with treated seawater or an inert gas such as nitrogen. It is considered credible that an unplanned release of treated seawater or nitrogen could occur from the subsea DC supply pipeline during CoP (preservation) phase. An unplanned release of nitrogen is assessed in Section 7.11. The potential hazard sources that could cause an unplanned release of treated seawater from the DC supply pipeline include: • Internal/external corrosion • Anchor impact dragging • Loss of suspended load from a visiting vessel A subsea release from the DC supply pipeline spill scenario is credible anywhere along the DC supply pipeline in Commonwealth waters. A subsea release at the CSD and HDD crossing has been modelled as the locations are both close to sensitive receptors. The maximum credible release at the HDD crossing would result in a subsea pipeline leak of 4,676 m^3 of treated seawater (containing chemicals and residual hydrocarbons) over 27 minutes with a discharge rate of 10,291 m^3/hr. 27 minutes is the time calculated for the pipeline to reach pressure equalisation. The maximum credible release at the CSB would result in a subsea pipeline leak of 1,740 m^3 of treated seawater (containing chemicals and residual hydrocarbons) over 12 minutes with a discharge rate of 8,886 m^3/hr. 12 minutes is the time calculated to reach pressure equalisation. Initial concentrations of the chemical treatment and hydrocarbons in the discharged seawater are assumed to be 1,000 ppm and 30 ppm, respectively. Santos plans to use a combined biocide and oxygen scavenger chemical treatment package, likely Hydrosure 0-3670R, for treating seawater and preserving flowlines. The treated seawater will comprise seawater, oxygen scavenger (to control corrosion) and biocide (to prevent biofouling on the internal surfaces of the pipeline) that have been assessed through the Santos chemical selection procedure to ensure that environmentally acceptable products are used or the risks can be demonstrated to be ALARP from the use of other chemicals. There are no events identified that could result in a pin hole leak in the DC supply pipeline less than the low-pressure alarm trigger (6000 kPa), other than a cyclone.
Extent	The results from the modelling of the release at the HDD crossing indicate that at a concentration level of PC99% (at, or above, 0.06 ppm), the maximum distances from the release location were 4.14 km for the 50th percentile and 7.16 km for the 95th percentile. The results from the modelling if the release at the CSB indicate that at a concentration level of PC99% (at, or above, 0.06 ppm), the maximum distances from the release location were 0.19 km for the 50th percentile and 14.78 km for the 95th percentile.
Duration	The duration of the release at the HDD crossing is estimated at 27 minutes at a rate of 10,291 m^3/hr. The duration of the release at the CSB is estimated at 12 minutes at a rate of 8,886 m^3/hr.

7.10.2 Nature and scale of environmental impacts

Potential receptors: physical environment (water quality, benthic habitat); threatened, migratory or local fauna; socioeconomic receptors; and cultural features.

The potential environmental impacts from planned treated seawater discharges include:

- temporary localised decline in water quality in the immediate vicinity of the discharge
- toxicity to marine fauna.

7.10.2.1 Modelling Parameters and results

Modelling parameters and setup

RPS (2024c) simulated near-field mixing and dispersion of an unplanned release of treated water using the three-dimensional flow model, CORMIX. A summary of the treated seawater discharge characteristics are presented in Table 7-25. The discharge was anticipated to have a salinity and temperature as per ambient waters.

Table 7-25: Summary of the treated seawater discharge characteristics

Parameter	Inputs HDD crossing	Inputs CSB
Total volume of treated seawater released (m^3)	4,676	1,740
Flow rate (m^3/hr)	10,291	8,886
Internal diameter of outlet pipe (mm)	374.66	374.66
Outlet pipe orientation	Full bore rupture	Full bore rupture
Discharge location	Pipeline at HDD crossing	Pipeline at CSB
Water depth at discharge (m)	5	38
Discharge temperature (same as ambient seawater)	26.5	26.2
Discharge salinity (same as ambient seawater)	35.4	35.4

Far-field modelling was completed to allow the time-varying nature of currents to be included and for the potential for localised build-up when current speeds are low (e.g. at the turning of the tide) and recirculation of the plume back to the discharge location might occur. The mixing and dispersion of the chemical treatment and hydrocarbons was predicted using the three-dimensional discharge and plume behaviour model, MUDMAP. 25 simulations were run for each season (3) and each simulation had a different start time, which ensured a range of current conditions were sampled. In total 75 simulations were modelled as part of the assessment, which were reported on an annual basis (RPS, 2024c). Each simulation was run for 72 hours.

Note the concentrations presented assume the background concentration of the chemical treatment and hydrocarbons in the receiving waters is zero and there is no biodegradation of the chemical treatment during the simulation.

Whole of Effluent Toxicity T Testing

To evaluate the environmental impact of discharging treated effluent into the marine environment, Santos utilised the Whole of Effluent Toxicity (WET) testing study conducted for Hydrosure by Chevron (Chevron, 2015). As this is likely the type of combined water treatment chemical that will be used for preservation of the DC supply pipeline. This testing study aimed to determine the potential toxicity of the effluent on a variety of local marine species under different exposure concentrations.

Testing was undertaken according to protocols recommended by the Australian and New Zealand Guidelines for fresh and marine water quality (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 (ANZECC and ARMCANZ, 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 (Chevron 2015).

Key findings from the Chevron (2015) study indicated the No Observable Effects Concentration (NOEC) for the treated effluent. For a 99% species protection level (PC99), the NOEC was determined to be 0.06 mg/L. For a 95% species protection level (PC95), the NOEC was slightly higher at 0.1 mg/L (RPS, 2024b).

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 hours. 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 hours) 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 hours).

Table 7-26: Ecotoxicological testing results for Hydrosure

Species	Test	Type	EC10 ppm	EC50 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
Saccostrea echinata	48-hour larval abnormality	Chronic	0.29	0.54	0.50	0.250

Species	Test	Type	EC10 ppm	EC50 ppm	LOEC ppm	NOEC ppm
(mollusc)			(0.24–0.33)	(0.52–0.56)		
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

Based on an initial concentration of 1,000 ppm for the chemical treatment in the treated seawater, the necessary dilution to achieve the target concentration of 0.06 ppm for the PC99% is 1:16,667. The NOEC values for varying species protection levels and the dilutions to achieve the concentration based on an initial dosage of 1,000 mg/L are presented in Table 7-27. A 1:16,667 dilution is required to achieve a PC99%.

Table 7-27: Species protection concentrations for Hydrosure 0-3670R

Species protection level	NOEC threshold (mg/L)	Dilutions required to achieve the NOEC threshold based on an initial dosing concentration of 1,000 ppm (mg/L)
PC99%	0.06	1:16,667
PC95%	0.10	1:10,000
PC90%	0.15	1:6,6667
PC80%	0.23	1:4,348

Source: Chevron (2015)

Far field modelling results- HDD crossing

All 75 simulations were consolidated and analysed to generate annual-based results. Figure 7-5 and Figure 7-6 illustrate the predicted extents for the 50th and 95th percentile chemical treatment concentrations. As outlined in Figure 7-5 the 50th percentile chemical concentration extends up to 4.14 km from the discharge point. In Figure 7-6 the 95th percentile chemical concentration extends up to 7.16 km from the discharge point. The modelling results also indicate that the chemical concentrations do not exceed NOEC thresholds for more than 144 hours. These figures reveal that the plume predominantly aligns along the northwest-southeast axis consistent with prevailing current conditions at the site and extending further eastward adjacent to the coastline.

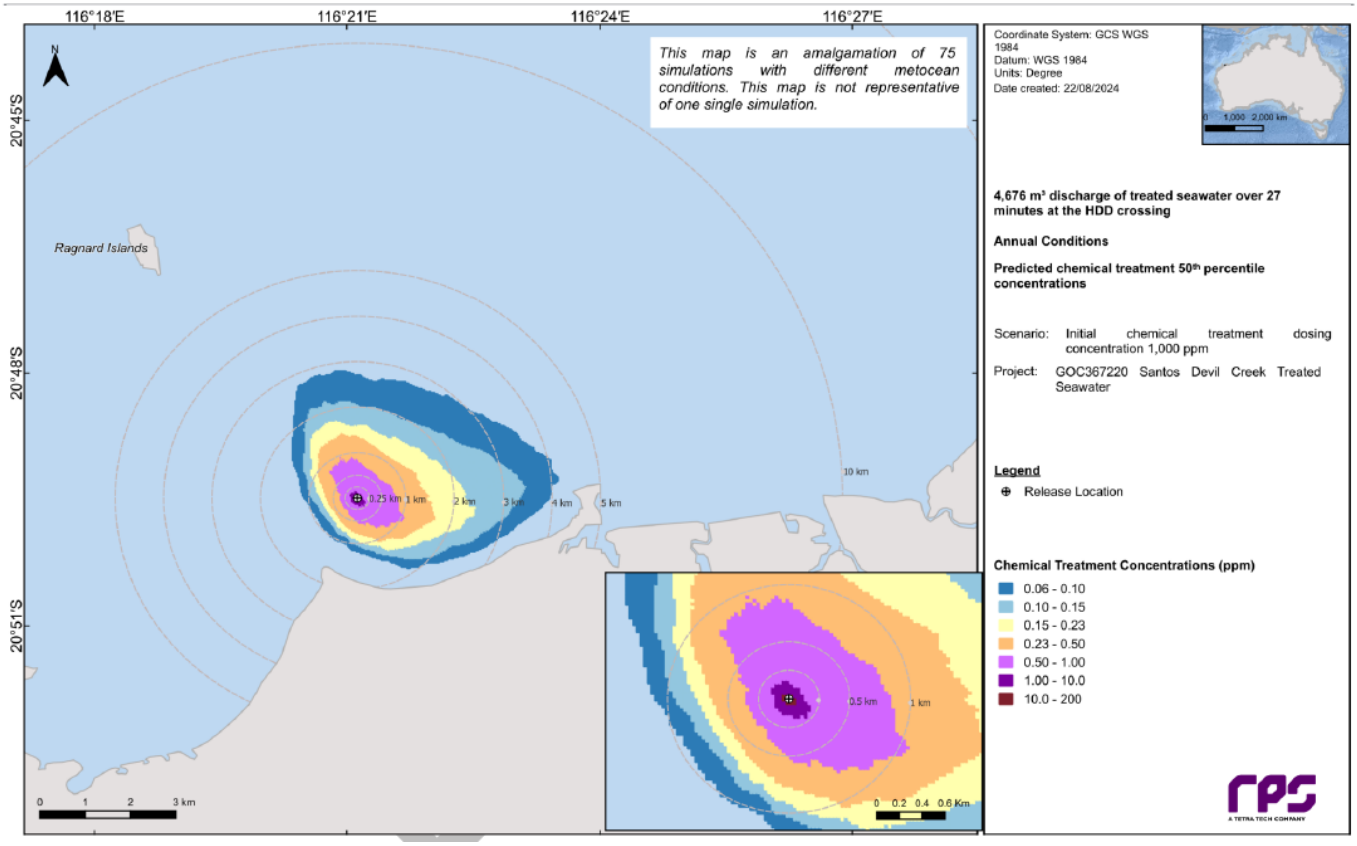


Figure 7-5 :Predicted extent of the 50th percentile chemical treatment concentrations (annualised)—HDD crossing

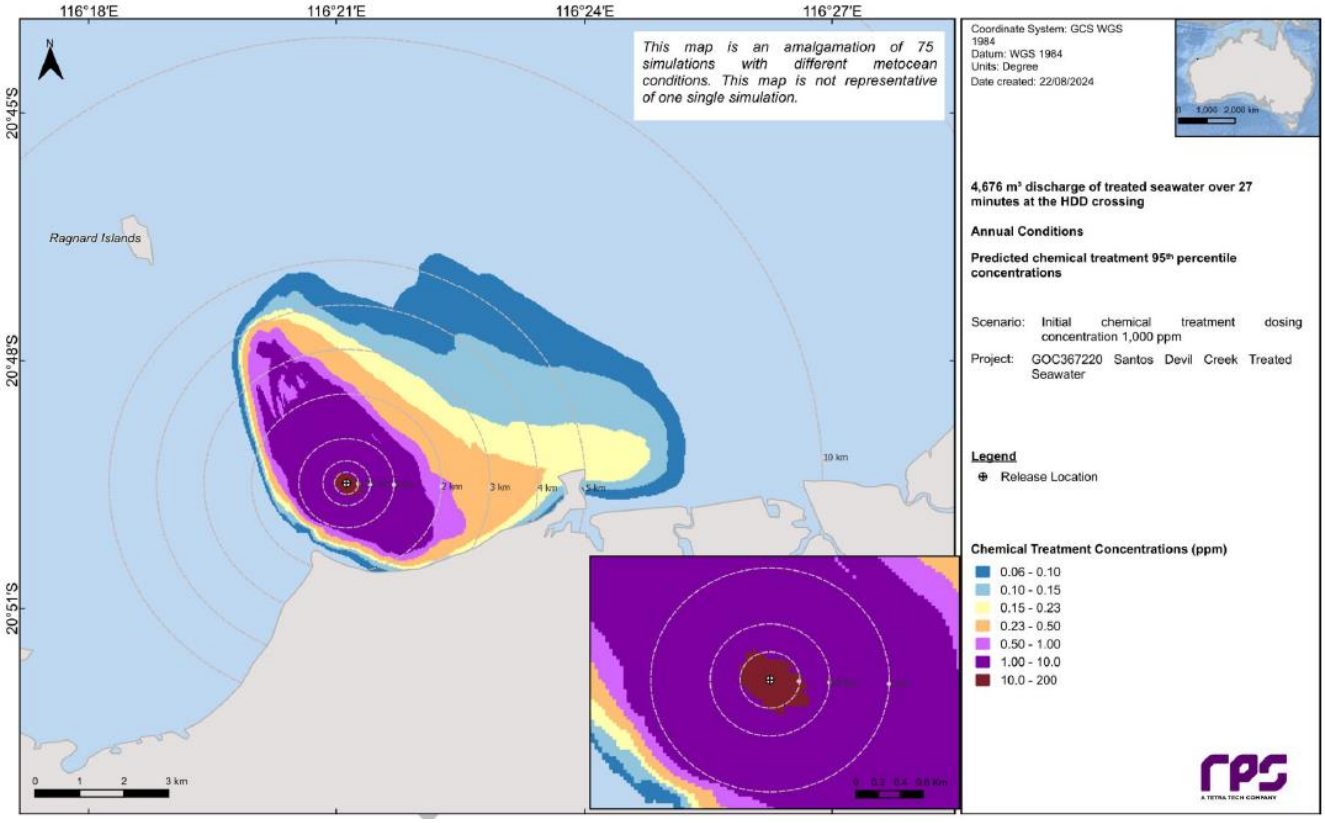


Figure 7-6: Predicted extent of the 95th percentile chemical treatment concentrations (annualised)—HDD crossing

Table 7-28 summarises the maximum distances from the HDD crossing release point to achieve the NOEC values for varying species protection levels for the 50th and 95th percentile concentrations.

Table 7-28: Maximum distances from the release location to achieve the NOEC values for varying species protection levels for the 50th and 95th percentile chemical treatment concentrations

Initial chemical treatment concentration (ppm)	Species protection level	NOEC value (mg/L)	Maximum distance (km) from the HDD crossing to the exposure value based on the 50th percentile statistics	Maximum distance (km) from the HDD crossing to the exposure value based on the 95th percentile statistics
1,000	PC99%	0.06	4.14	7.16
	PC95%	0.10	3.50	6.84
	PC90%	0.15	2.45	6.42
	PC80%	0.23	1.69	4.22

Far field modelling results-CSB

All 75 simulations were consolidated and analysed to generate annual-based results. Figure 7-5 and Figure 7-6 illustrate the predicted extents for the 50th and 95th percentile chemical treatment concentrations. As outlined in Figure 7-5 the 50th percentile chemical concentration extends up to 0.19 km from the discharge point. In Figure 7-6 the 95th percentile chemical concentration extends up to 14.78 km from the discharge point. However it reaches a low concentration of 0.15–0.23 ppm within 10 km of the discharge point. The modelling results also indicate that the chemical concentrations do not exceed NOEC thresholds for more than 36 hours. These figures reveal that the plume predominantly aligns along the northeast-southwest axis, consistent with the prevailing current directions at the site.

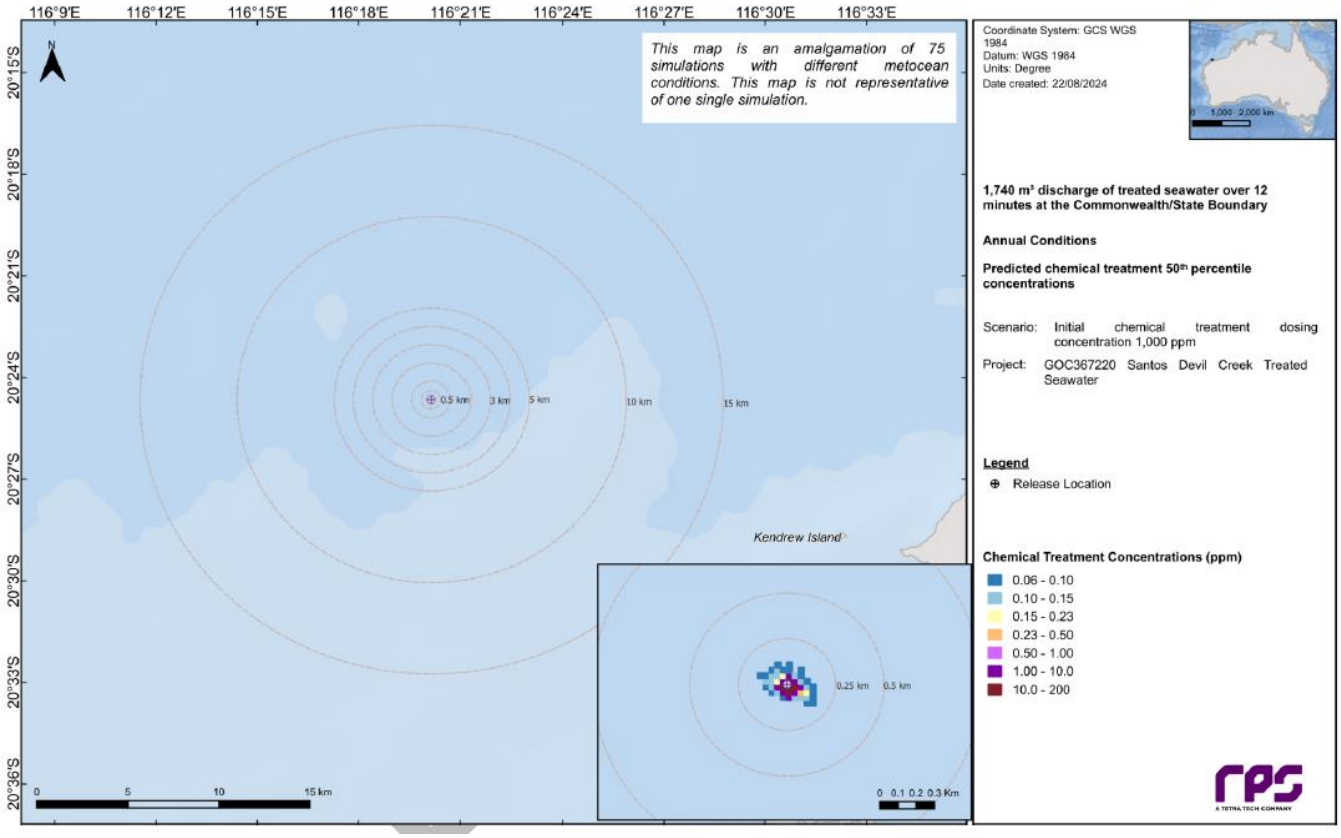


Figure 7-7: Predicted extent of the 50th percentile chemical treatment concentrations (annualised)—CSB

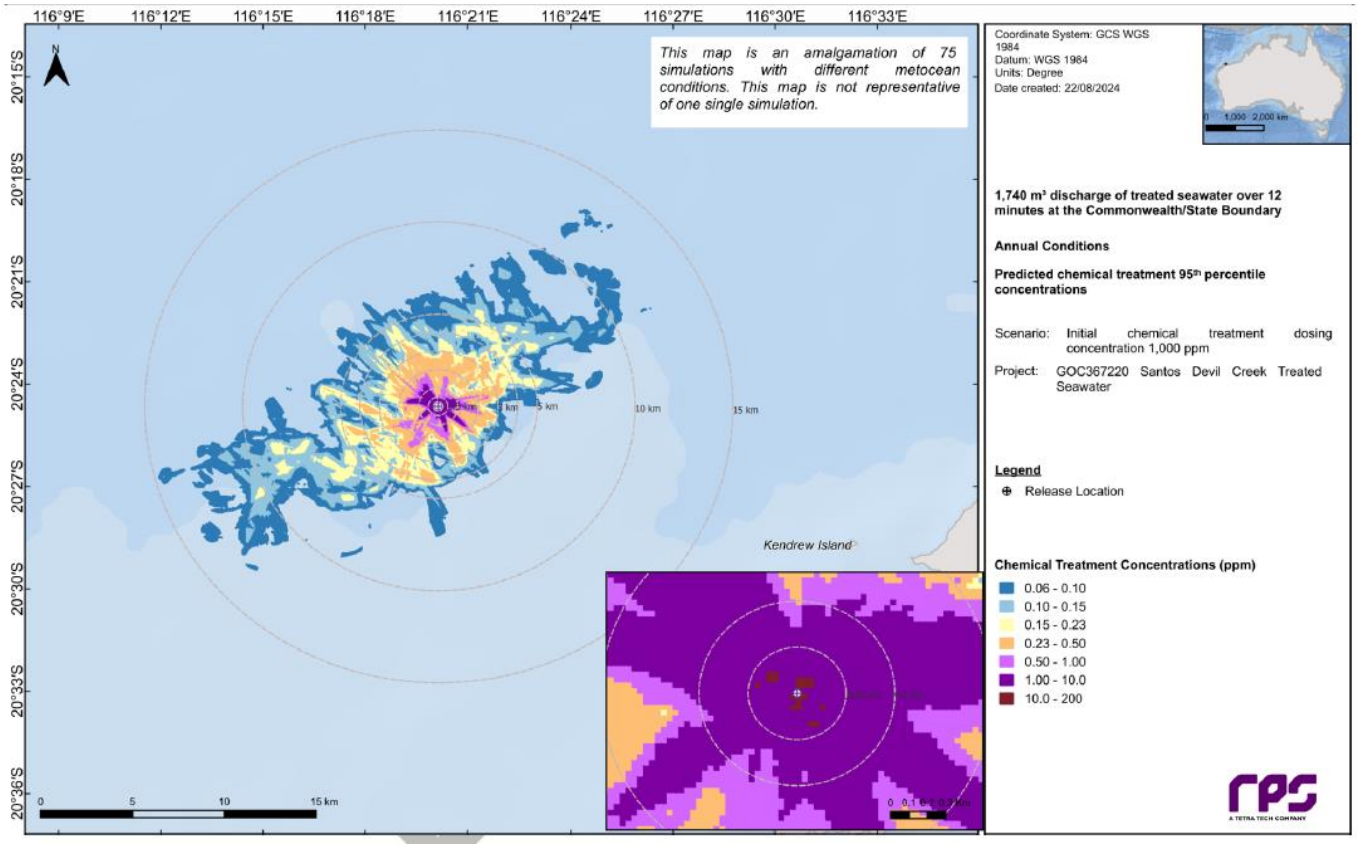


Figure 7-8: Predicted extent of the 95th percentile chemical treatment concentrations (annualised)—CSB

Table 7-29 summarises the maximum distances from the CSB release point to achieve the NOEC values for varying species protection levels for the 50th and 95th percentile concentrations.

Table 7-29: Maximum distances from the release location to achieve the NOEC values for varying species protection levels for the 50th and 95th percentile chemical treatment concentrations—CSB

Initial chemical treatment concentration (ppm)	Species protection level	NOEC value (mg/L)	Max. distance (km) from the CSB to the exposure value based on the 50th percentile statistics	Max. distance (km) from the CSB to the exposure value based on the 95th percentile statistics
1,000	PC99%	0.06	0.19	14.78
	PC95%	0.10	0.15	14.56
	PC90%	0.15	0.13	10.57
	PC80%	0.23	0.11	5.92

7.10.2.2 Impacts to physical environment

Water quality

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 1000 ppm, whereas the likely dosage rate may be less than this. In practice, the concentration of Hydrosure in the treated seawater will naturally degrade over time during the discharge 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 unplanned release of treated sea water will result in a localised (around the discharge location) and temporary minor reduction in water quality. The modelling results indicate that chemical concentrations do not exceed the NOEC thresholds for more than 144 hours. 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 the unplanned and therefore the impact is assessed as minor.

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 plume 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 minor.

Sediment quality

Modelling results indicate that the plume is neutrally buoyant and does not exceed NOEC thresholds for more than 144 hours. Therefore, no impact to sediment quality is expected.

7.10.2.3 Impacts to threatened or migratory fauna

As discussed in the sections above, the discharge extent for the unplanned release of treated seawater is localised (up to 7.16 km), and rapid dilution is predicted to occur within the offshore waters. An unplanned release of treated sea water may result in 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 7-26). Modelling results indicate that chemical concentrations will not exceed NOEC thresholds for more than 36 hours.

Marine fauna in the vicinity of the CSB/HDD crossing are likely to be transient. If present, marine fauna could pass through the plume of treated seawater and would be exposed for a short duration.

The HDD crossing overlaps the following BIAs:

- The humpback whale migration BIA
- The flatback turtle internesting BIA
- The wedge-tailed shearwater and fairy tern breeding BIAs

The CSB overlaps the following BIAs:

- The humpback whale migration BIA
- The flatback turtle internesting BIA
- The green turtle nesting BIA
- The hawksbill turtle nesting BIA
- The wedge-tailed shearwater and roseate tern breeding BIAs

Therefore these species are more likely to be encountered in the vicinity of the unplanned release. However, if contact does occur with any marine fauna, it will be for a short duration due to the rapid dispersion of the plume and the transient fauna movement, such that any exposure is likely not of sufficient duration to cause a toxic effect within the radius of the potential affected area. Turtle nesting BIAs in the area will not be significantly modified of affected, as the unplanned release of treated seawater under goes rapid dilution and dissipation in the open ocean waters. The modelling results also indicate that the NOEC will not be exceeded for more than 144 hours.

Discharges may cause changes to behaviour in marine fauna (avoidance). However, this release is expected to undergo rapid dilution and dispersion so any behavioural impacts are expected to be minimal and short term.

Toxicity impacts to receptors from the release of treated seawater are unlikely to eventuate because:

- strong ocean currents result in the discharge being further diluted upon release to the marine environment, so the duration of exposure of chemicals to fauna will be minimal
- the chemicals will have been risk assessed for their suitability for discharge using Operations Chemical Selection Evaluation and Approval Procedure (EA-91-II-10001)
- the sensitivity of the receiving environment is considered low
- potential discharges will short term and temporary within the operational area.

7.10.3 Environmental performance and control measures

Environmental performance outcomes (EPOs) relating to this event include:

- No unplanned objects, emissions or discharges to sea or air [EPO-DC-07].

The control measures considered for this activity are shown in Table 7-30 with EPSs and measurement criteria for the EPOs described in Table 8-2.

Table 7-30: Control measures evaluation for treated seawater discharge

Ref. No.	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-13	Planned subsea and offshore maintenance.	Administrative	Reduces likelihood of leaks from equipment and ensures ongoing integrity of subsea infrastructure.	Personnel and operational costs associated with undertaking regular inspections of all subsea equipment.	Adopted – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
DC-CM-45	Inspection and corrosion monitoring.	Administrative	Regular inspections reduce the risk of leaks from subsea pipelines by confirming appropriate integrity.	Costs associated with personnel time in performing the inspections, monitoring and reporting inspections and follow up actions.	Adopted – Benefits considered to outweigh costs.
DC-CM-15	Navigational charts	Administrative	Provides a means for marine users to be aware of the presence of the subsea infrastructure.	Costs associated with personnel time in issuing notifications.	Adopted – Benefits considered to outweigh costs.
DC-CM-33	Dropped object prevention procedures.	Administrative	Impacts to environment are reduced by preventing dropped objects. Minimises drop risk during lifting operations. Requires lifting equipment to be certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	Adopted – Benefits considered to outweigh costs.
DC-CM-14	Anchoring and equipment deployment management.	Administrative	Anchoring and placement of equipment is controlled through ensuring that any anchoring occurs at pre-approved locations, thereby reducing potential environmental impacts.	Costs associated with implementing procedures.	Adopted – Benefits considered to outweigh costs.
DC-CM-26	Chemical selection procedure.	Administrative	Reduced toxicity to marine environment. Only environmentally acceptable chemicals would be released in the event of an accidental discharge to sea.	Cost associated with implementation of procedure. Range of chemicals reduced but potentially higher costs. Potential additional cost and delays of chemical substitution.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweighs costs.
DC-CM-27	General chemical management procedures.	Administrative	Potential impacts to the environment are reduced through following correct procedures for the safe handling and storage of chemicals.	Personnel costs associated with ensuring procedures are in place and implemented during handling and storage of chemicals.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs.

Ref. No.	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
DC-CM-48	Pipeline flushing prior to opening of the subsea system.	Engineering	Production fluids (hydrocarbons) will be flushed through with treated water to the DCGP prior to opening the system. Reduces the toxicity of chemicals and residual hydrocarbons in subsea infrastructure before any release to sea during activities.	Additional costs and time taken to flush DC supply pipeline.	Adopted – Environmental benefits of flushing outweigh the associated costs.
DC-CM-49	Calibrated dosing system in place to ensure accuracy of chemical dosing	Engineering	Santos temporary equipment assessment procedure (SO-91-IG-10050) ensures calibration and independent verification of temporary equipment used for chemical dosing of the treated seawater therefore managing potential impact to marine environment to acceptable levels	Implementation of a procedure; cost of independent verification	Adopted – Benefits of ensuring correct chemical dosing maintains pipeline integrity and reduces the potential environmental impact
DC-CM-50	Testing of pipeline preservation fluids	Engineering	Ensures pipeline integrity is maintained through testing for bacterial colonies in the pipeline contents which is an indicator for less of effectiveness of preservation. Maintaining pipeline integrity prevents loss to the marine environment	Cost of testing and implementing procedures	Adopted – Benefits of ensuring pipeline is effectively preserved maintains pipeline integrity and reduces the potential environmental impact
Additional Control Measures					
DC-CM-51	Pipeline is positively isolated at minimum pressure	Engineering	Positively isolating pipeline at minimum pressure reduced the volume of seawater that would be released in the event of a pipeline rupture.	Cost of implementing procedures	Adopted – Reducing the potential pipeline release volume reduces the potential environmental impact
DC-CM-52	Activate the relevant scientific monitoring plans as per the operational and scientific services arrangement in place in the OPEP	Protective	Scientific monitoring determines the extent and duration of the impact.	Cost of implementing water quality monitoring	Adopted –To determine extent and duration of impact.

7.10.4 Environmental impact assessment

Description- Unplanned Release of Treated Seawater	
Receptors	Threatened, migratory, or local fauna Protected areas Physical environment or habitats Socio-economic receptors
Pre-treatment consequence	II-Minor
Consequence	II-Minor

Threatened, migratory, or local fauna

Changes to water quality may result in an alteration to marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, marine turtles and mammals, and seabirds.

No physical environments or habitats are identified in the area over which treated seawater discharges are expected to disperse other than open water.

The HDD crossing overlaps the following BIAs:

- The humpback whale migration BIA
- The flatback turtle internesting BIA
- The wedge-tailed shearwater and fairy tern breeding BIAs

The CSB overlaps the following BIAs:

- The humpback whale migration BIA
- The flatback turtle internesting BIA
- The green turtle nesting BIA
- The hawksbill turtle nesting BIA
- The wedge-tailed shearwater and roseate tern breeding BIAs

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 plume and restriction to the surface waters only, 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.

Any effects on water quality are expected to be highly localised and within the surface waters only and have little to no effect on seabed receptors. The consequence level for threatened, migratory or local fauna is considered to be II-Minor.

Physical environment or habitat

Impacts to water quality that will be experienced in the discharge mixing zone will be localised and will occur only as long as the discharges occur (i.e. no sustained impacts); therefore, recovery will be measured in days.

Given highly dispersive waters of the open ocean environment and that the modelling results also indicate that the NOEC threshold will not be exceeded for more than 144 hours impacts will be limited to short-term water quality impacts.

Given the temporary (144 hours) 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 the treated seawater discharges and therefore the impact is assessed as acceptable. The consequence level for physical environment or habitat is considered to be II- Minor.

Threatened ecological communities

Not applicable – No threatened ecological communities are identified in the area over which the treated seawater discharge will disperse.

Protected areas

Not applicable – No protected areas are identified in the area over which the treated seawater discharge will disperse.

Socio-economic receptors

There is limited activity by commercial fishers, recreation and tourism that overlap the operational area. Contact from the short-term discharge of treated seawater will be limited to transient fauna individuals where exposure time will unlikely cause a toxic effect. Given the minor consequence to species, subsequent impacts to socioeconomic receptors are not anticipated. EP stakeholder consultation did not raise any concerns regarding potential impacts to cultural features including sea country. In addition, no stakeholder concerns have been raised regarding this event.

The consequence level for the socioeconomic receptors is considered to be II-Minor.

Likelihood	a-Remote

A treated seawater release resulting from a DC supply pipeline rupture caused by an integrity or corrosion issue, dropped object or anchor drag is unlikely to have widespread ecological effects, given the composition of treated seawater, the safety

Description- Unplanned Release of Treated Seawater	
design of the production system, the limited volumes that could be released, the water depth and the transient nature of marine fauna in this area. Deteriorating water quality is identified as a potential threat to turtles in the marine turtle recovery plan and to some bird and shark species (Table 3-9). Habitat modification, degradation, disruption, and loss are also identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. However, the potential treated seawater releases as a result of DC supply pipeline rupture are not expected to significantly impact the receiving environment, given the management controls proposed. Additionally, long-term impacts resulting in complete habitat loss or degradation are not considered likely, given the controls proposed to prevent releases; therefore, the activity will be conducted in a manner that is considered acceptable. The likelihood of a treated seawater release occurring due to DC supply pipeline rupture is limited by the set of mitigation and management controls in place. Consequently, the likelihood of a DC supply pipeline rupture releasing treated seawater to the environment which results in a minor consequence is considered to be a-Remote.	
Residual Risk	Very Low

7.10.5 Demonstration of ALARP

The use of chemicals to preserve pipelines is a standard technique that is considered critical in maintaining equipment integrity and preventing potential environmental incidents and is unavoidable for the activity. The use of treated seawater is an industry standard and uses chemicals that have been appropriately risk assessed under the Operations Chemical Selection Evaluation and Approval Procedure (EA 91 II 10001).

The volume of discharge will occur in a deep-water location with rapid dispersion. The modelling results also indicate that the NOEC will not be exceeded for more than 36 hours.

Applying a chemical selection process (see Section 2.9) 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.

The identified causes of DC supply pipeline rupture from external factors are through a loss of integrity, corrosion, dropped objects and anchor drag. A number of procedural controls are in place that reduce the likelihood of these events. Eliminating the potential from dropped objects and anchoring is not feasible since vessel activity is also inherent in the activities (e.g. inspection and maintenance activities using ROVs and divers).

The subsea DC supply pipeline is designed to reduce the potential for rupture and release of treated seawater to the marine environment. The integrity of the subsea production system is maintained through planned inspection, monitoring and testing of its components, ensuring that the system operates within its design requirements and that there is no unacceptable degradation of the system (e.g. materials, or ESD valve shutdown time or leakage).

During the CoP phase the pipeline has been cleaned of hydrocarbons, filled with treated seawater and positively at a minimum pressure. In the event of a pipeline rupture during the preservation phase, the pipeline has already been isolated from the subsea system. As the pipeline is a minimum pressure during the preservation phase, pressure equilibrium is reached earlier thus reducing the potential discharge volume.

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 7.10.3.Therefore, the impacts of treated seawater discharges are considered ALARP.

7.10.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – the residual risk of a release of treated seawater is ranked *Very Low*.
Is further information required in the consequence assessment?	No – Potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecologically sustainable development?	Yes – Activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, 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 3-9.

Are risks and impacts consistent with Santos' Environment, Health & Safety Policy?	Yes – Aligns with Santos Environment, Health & Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – No concerns raised by stakeholders for this event.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – See ALARP above.

The likelihood of a subsea treated seawater release from the DC supply pipeline is Remote when considering industry statistics, Santos statistics and the preventive controls in place. Additional industry standard and activity-specific control measures to reduce the chance of the event occurring (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the safety case, personnel training and awareness.

In accordance with Santos WA's risk assessment process, the residual risk is considered to be Very Low and ALARP. The proposed control measures will reduce the risk of impacts from a subsea DC supply pipeline treated seawater release to a level that is considered acceptable.

7.11 Unplanned release of nitrogen

7.11.1 Description of event

Event	Once the Reindeer facilities reach the end of field life they will need to be flushed of hydrocarbons and preserved for future decommissioning or other uses. Following flushing of the pipeline to DCGP, the pipeline will be filled with treated seawater. Following flushing the pipeline may be re-preserved with treated seawater or an inert gas such as nitrogen. It is considered credible that an unplanned release of nitrogen could occur from the subsea DC supply pipeline during CoP (preservation) phase. The potential hazard sources that could cause an unplanned release of nitrogen from the DC supply pipeline include: • Internal/external corrosion • Anchor impact dragging • Loss of suspended load from a visiting vessel The maximum credible release is 124,618 kg of nitrogen gas (100% loss of containment). Since nitrogen gas is non-flammable and in a low volume, the primary concern would be the risk of asphyxiation marine environment due to the natural dilution from wind and water depth resulting in rapid dispersion. However, it is unlikely, given these effects are greatly diminished in the offshore release rate.
Extent	The subsea release from the DC supply pipeline spill scenario is credible anywhere along the DC supply pipeline in Commonwealth waters. The CSB and the HDD crossing have been has been used as the location for this release as they are closest to sensitive receptors. Nitrogen modelling undertaken for the Barossa Darwin Pipeline Duplication (DPD) EP was used to inform this risk assessment. The modelling results are highly conservative, as nitrogen release scenario in the Barossa DPD EP is 3,000 tonnes of nitrogen at a relatively low pressure between 10 and 35 bar. The nitrogen dispersion modelling (Add Energy, 2023) of the unplanned nitrogen release from the Barossa DPD EP 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 7-31). 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. This impact extent is conservative as the release volume is used in the modelling 3,000 tonnes is significantly higher than the predicted release volume from the DC supply pipeline (124,618 kg).
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 ~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 7-31). 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 7-31: 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

7.11.2 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.

7.11.2.1 Physical environment

The seabed at the CSB is characterised by soft unconsolidated sediments (RPS, 2008). Benthic primary producer habitat (e.g. areas of hard corals, seagrass or macroalgae) is unlikely to be present in the operational area, given that the water depths range between ~38 and 58 m (NGI, 2018). Benthic primary production at these depths are limited due to insufficient light availability (RPS, 2008).

Any seabed disturbance impacts (e.g. scouring) are expected to be limited to the immediate vicinity of the DC supply 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.

A DC supply pipeline rupture and subsequent release of nitrogen gas potentially could result in a localised nitrogen gas plume that would dissipate within minutes. 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.

7.11.2.2 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 there are no fish aggregation sites in the vicinity of the release- impacts are limited to transiting individuals which are not considered to results in population level effects. Habitat modification, degradation and disruption, pollution and/or loss of habitat are identified as threats to sharks, birds, cetaceans and turtles in conservation management and recovery plans. With controls in place, that are in line with relevant actions described in various recovery plans, the activity will be conducted in a manner that reduces potential impacts to ALARP and an acceptable level.

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.

7.11.2.3 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 primary activity vessel 500 m safety exclusion zone; therefore, outside the predicted extent if an unplanned event occurs.

7.11.3 Environmental performance outcomes and control measures

The EPO relating to this event is:

- No unplanned objects, emissions or discharges to sea or air [EPO-DC-07].

The control measures considered for this activity are shown in Table 7-32 with EPSs and measurement criteria for the EPOs described in Table 8-2.

Table 7-32: Control measures evaluation for unplanned release: nitrogen gas

Ref. No.	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls					
DC-CM-13	Planned subsea and offshore maintenance.	Administrative	Reduces likelihood of leaks from equipment and ensures ongoing integrity of subsea infrastructure.	Personnel and operational costs associated with undertaking regular inspections of all subsea equipment.	Adopted – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
DC-CM-44	DEMIRS-accepted safety case.	Administrative	Includes control measures for pipeline integrity and management controls.	Costs associated with personnel time in writing, reviewing and implementing the safety case.	Adopted – Benefits considered to outweigh costs. Regulatory requirement must be adopted.
DC-CM-45	Inspection and corrosion monitoring.	Administrative	Regular inspections reduce the risk of leaks from DC supply pipeline by confirming appropriate integrity.	Costs associated with personnel time in performing the inspections, monitoring and reporting of inspections and follow-up actions.	Adopted – Benefits considered to outweigh costs.
DC-CM-15	Navigational charting of infrastructure	Administrative	Provides a means for marine users to be aware of the presence of the platform and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	Adopted – Benefits considered to outweigh costs.
DC-CM-33	Dropped object prevention procedures.	Administrative	Impacts to environment are reduced by preventing dropped objects. Minimises drop risk during lifting operations. Requires lifting equipment to be certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	Adopted – Benefits considered to outweigh costs.
DC-CM-14	Anchoring and equipment deployment management.	Administrative	Anchoring and placement of equipment is controlled through ensuring that any anchoring occurs at pre-approved locations, thereby reducing potential environmental impacts.	Costs associated with implementing procedures.	Adopted – Benefits considered to outweigh costs.
DC-CM-48	Pipeline flushing prior to opening of the subsea system.	Engineering	Production fluids (hydrocarbons) will be flushed through with treated water to the DCGP prior to opening the system. Reduces the toxicity of chemicals and residual hydrocarbons in subsea	Additional costs and time taken to flush DC supply pipeline.	Adopted – Environmental benefits of flushing outweigh the associated costs.

Ref. No.	Control Measure	Hierarchy of Control	Environmental Benefit	Potential Cost/Issues	Evaluation
			infrastructure before any release to sea during activities.		
Additional Control Measures					
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.	N/A

7.11.4 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
Pre-treatment consequence	_I-Negligible
Consequence	I – Negligible
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 a few 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 I – Negligible. Given the 500 m safety exclusion zone that will be in force around the primary activity 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	a-Remote
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 remote.	
Residual Risk	Very Low.

7.11.5 Demonstration of as low as reasonably practicable

The identified causes of DC supply pipeline rupture from external factors are through a loss of integrity, corrosion, dropped objects and anchor drag. A number of procedural controls are in place that reduce the likelihood of these events. Eliminating the potential from dropped objects and anchoring is not feasible since vessel activity is also inherent in the activities (e.g. inspection and maintenance activities using ROVs and divers).

The subsea DC supply pipeline is designed to reduce the potential for rupture and release of nitrogen to the marine environment. The integrity of the subsea production system is maintained through planned inspection, monitoring and testing of its components, ensuring that the system operates within its design requirements and that there is no unacceptable degradation of the system (e.g. materials, or ESD valve shutdown time or leakage).

During the CoP phase the pipeline has been cleaned of hydrocarbons, filled with treated seawater and positively at a minimum pressure. In the event of a pipeline rupture during the preservation phase, the pipeline has already been isolated from the subsea system. As the pipeline is a minimum pressure during the preservation phase, pressure equilibrium is reached earlier thus reducing the potential discharge volume.

The consequence was assessed as I-Negligible 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 7.11.3. Therefore, the impacts of treated seawater discharges are considered ALARP.

7.11.6 Acceptability evaluation

Is the risk ranked between Very Low to Medium?	Yes – residual risk is ranked Very Low
Is further information required in the consequence assessment?	No – potential impacts and risks are well understood through the information available.
Are risks and impacts consistent with the principles of ecological sustainable development (ESD)?	Yes – activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure, which considers principles of ecologically sustainable development.
Are risks and impacts consistent with relevant legislation, international agreements and conventions, guidelines and codes of practice (including species recovery plans, threat abatement plans, 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 3-9.
Are risks and impacts consistent with Santos' Environment, Health and Safety Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes – see ALARP above.

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

P(SL)(E)R 2012 Requirements
Regulation 15(1)
The environment plan must include an implementation strategy for the petroleum activity in accordance with this regulation.

The specific measures and arrangements that will be implemented in the event of an oil pollution emergency are detailed within the oil pollution emergency plan (OPEP) which can be found in Appendix H.

Stakeholder engagement is assessed separately for the requirements of the DC Activities. Ongoing stakeholder management strategies are discussed in Section 4.

8.1 Environmental management system

P(SL)(E)R 2012 Requirements
Regulation 15(3)
The implementation strategy must identify the specific systems, practices and procedures to be used to ensure that: a. The environmental impacts and environmental risks of the petroleum activity are continuously reduced to as low as is reasonably practicable; and b. The environmental performance objectives and environmental performance standards in the environment plan are met.

The Santos Management System exists to support its ethical, professional and legal obligations to undertake work in a manner that does not cause harm to people or the environment. The Santos management system is a framework of policies, standards, processes, procedures, tools and control measures that, when used together by a properly resourced and competent organisation, result in these outcomes:

- A common HSE approach is followed across the organisation
- HSE is proactively managed and maintained
- The mandatory requirements of HSE management are implemented and are auditable
- HSE management performance is measured and corrective actions are taken
- Opportunities for improvement are recognised and implemented
- Workforce commitments are understood and demonstrated.

This implementation strategy is designed to meet the requirements of the EP to ensure that:

- Environmental impacts and risks continue to be identified for the duration of the activity and reduced to ALARP
- Control measures are effective in reducing environmental impacts and risks to ALARP and acceptable levels
- Environmental performance objectives and standards set out in this EP are met
- Stakeholder consultation is maintained throughout the activity as appropriate.

8.2 Environment, Health and Safety policy

Santos' Environment, Health & Safety Policy (Appendix A) clearly sets out Santos' strategic environmental outcomes and the commitment of the management team to continuous environmental performance improvement. This EP has been prepared in accordance with the fundamentals of this policy. By accepting employment with Santos, each employee and contractor is made aware during the recruitment process that he or she is responsible for the application of this policy.

8.3 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 (Sections 6 and 7 in accordance with the Offshore Division Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5). The control measures and environmental

performance standards that will be implemented to manage the identified risks and impacts and the environmental performance objectives that will be achieved are detailed below.

To ensure 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 Sections 6 and 7.

Any new, or proposed amendment, to a control measure or environmental performance standard or objective will be managed in accordance with the management of change procedure (Section 8.9).

Oil spill response control measures and environmental performance standards and objectives are listed in the OPEP (Appendix H).

8.4 Environmental performance objectives

To ensure environmental risks and impacts will be of an acceptable level, environmental performance objectives have been defined and are listed in Table 8-1 for planned activities and unplanned events, those relating to oil spill response are listed in the OPEP. These objectives will be achieved by implementing the identified control measures to the defined environmental performance standards.

Table 8-1: Environmental performance objectives (EP)

Reference	Environmental Performance Objectives
EPO-DC-01	No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed fauna during activities.
EPO-DC-02	Minimise impacts to marine fauna from lighting through limiting lighting to that required by safety and navigational lighting requirements.
EPO-DC-03	Minimise impacts to air and water quality from planned discharges and emissions from activities.
EPO-DC-04	Seabed disturbance is limited to planned activities and defined locations within the operational area.
EPO-DC-05	Minimise impacts on other marine users through the provision of information to relevant stakeholders such that they are able to plan for their activities and avoid unexpected interference.
EPO-DC-06	No introduction of marine pest species.
EPO-DC-07	No unplanned objects, emissions or discharges to sea or air
EPO-DC-08	No loss of containment of hydrocarbon to the marine environment.
EPO-DC-09	No loss of containment of hydrocarbon to the terrestrial environment.
EPO-DC-10	No fire as a result of activities within the DC pipelines corridor operational area.

8.4.1 Control measures and performance standards

P(SL)(E)R 2012 Requirements
Regulation 14(5)
The environment plan must include: c. Environmental performance standards: (i) That state the performance required of persons, equipment and procedures for the purposes of managing the environmental impacts and environmental risks of the petroleum activity; and (ii) Against which the performance of the operator in meeting the environmental performance objectives in the environment plan can be measured. d. Measurement criteria for the purposes of determining whether: (i) The environmental performance objectives and environmental performance standards in the environment plan have been met; and (ii) The implementation strategy in the environment plan has been complied with.

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. environmental performance standards) 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 and performance standards and associated measurement criteria relating to preparedness and response operations are contained within the Devil Creek Pipeline and Reindeer WHP OPEP (Appendix H).

Table 8-2: Control measures, environmental performance standards and measurement criteria for the proposed activity

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
Obtain a native vegetation clearing permit if required	DC-CM-01	Native vegetation clearing is managed in accordance with the Environmental Protection (Clearing of Native Vegetation) Regulations 2004	DC-CM-01-EPS-01	Receipt of native vegetation clearing permit	EPO-DC-01 EPO-DC-09	6.1, 7.9
Project execution plan for management of excavation activities	DC-CM-02	Where an activity may require excavation adjacent to the pipeline, a risk assessment and a project execution plan will be prepared. The project execution plan will include controls and requirements relevant to the impact of the activity, such as: • Planning and inductions, • Lighting controls, which may include: – Shielding applied to direct light – Consideration of LED low intensity lighting • Fire controls, which may include: – Management of ignition sources • Excavation controls, which may include: – Scheduling outside of sensitive periods – Provision of fauna escape/exclusion means including for excavations left open overnight • Water Management controls, which may include: – Drainage management • Acid sulphate management controls	DC-CM-02-EPS-01	Records demonstrate implementation of a project execution plan. Excavation certificate demonstrates that fauna escape methods are provided.	EPO-DC-01	6.1 7.5
Procedure for interacting with marine fauna	DC-CM-03	Vessels comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003), which ensures compliance with Part 8 of the EPBC Regulations 2000, which includes controls for minimising the risk of collision with marine fauna.	DC-CM-03-EPS-01	Statement of conformance, which demonstrates that the contractor is aware of the requirements of the Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) and commits to meeting them during the activity. Marine fauna observation records are maintained.	EPO-DC-01	7.2,
		Helicopter contractor procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003), which ensures compliance with Part 8 of the EPBC Regulations 2000,	DC-CM-03-EPS-02	Records indicate that - Santos have reviewed and approved that the helicopter operator's procedure include the relevant requirements from the Protected	EPO-DC-01	6.2, 7.2,

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		which includes controls for minimising interaction with marine fauna.		Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003). Incident database records show that there have been no breaches of the Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).		
		Any vessels strike with cetaceans will be reported in the National Ship Strike Database.	DC-CM-03-EPS-03	Conformance checked on Santo's receipt of incident report	EPO-DC-01	6.2, 7.2,
		UAV's comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which includes controls for minimising the risk of interaction with marine fauna.	DC-CM-03-EPS-04	Records indicate that - Santos have reviewed and approved that the UAV operator's procedure include the relevant requirements from the Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003). Incident database records show that there have been no breaches of the Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	EPO-DC-01	6.2, 7.2,
		Thruster guards are available for use on work class ROVs to help prevent ingress of small marine fauna into ROV thrusters. If marine fauna are being impacted and providing pilotage is not compromised, ROV thruster guards will be installed to prevent ingress of marine fauna into the thrusters.	DC-CM-03-EPS-05	Photographs of fitted thruster guards.	EPO-DC-01	6.2,7.2
Prestart requirements (for survey equipment)	DC-CM-04	Prior to commencing start-up of geophysical survey equipment in-water, the following will be completed: • A trained crew member (refer Section 8.6.2) observing for marine mammals, whale sharks or turtles within 500 m of the vessel during daylight for 15 minutes prior to start-up (if no sightings, survey can commence) • If marine mammals, whale sharks or turtles are sighted within 500 m of the geophysical	DC-CM- 04-EPS-01	Geophysical survey checklist completed prior to survey equipment commencement to provide evidence that pre-start requirements were followed.	EPO-DC-01	6.2

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		equipment prior to commencement of survey equipment, the operation will be delayed until the animal has moved at least 500 m away or 10 minutes has passed since the last sighting • Soft-start procedures enacted over 30 minutes (if equipment allows) • Night operations can commence if there were no more than 3 delays due to marine fauna in the preceding 24-hour period.				
Vessel planned maintenance system	DC-CM-05	Documented maintenance program is in place for equipment on vessels that provides a status on the maintenance of equipment.	DC-CM-05-EPS-01	Vessels have records that demonstrate maintenance is performed as per the vessel's planned maintenance system requirements.	EPO-DC-01 EPO-DC-03 EPO-DC-07 EPO-DC-08	6.2, 6.4, 7.3, 7.8
Navigation lighting and aids	DC-CM-06	Support vessel navigation equipment is compliant with SOLAS/AMSA Marine Order 30, Prevention of Collisions, and with Marine Order 21, Safety and Emergency Arrangements.	DC-CM-06-EPS-01	Vessel inspection records show support vessel navigation equipment is compliant with Marine Order 30 Prevention of Collisions, and with Marine Order 21, Safety and Emergency Arrangements.	EPO-DC-02 EPO-DC-05 EPO-DC-08	6.3, 6.6, 7.8
Premobilisation review and planning of lighting on vessels is undertaken prior to IMMR activities commencing.	DC-CM-07	Where an activity may require 24-hour lighting, a project execution plan, planning and inductions, will include a requirement to minimise external lighting where practicable during the activity.	DC-CM-07-EPS-01	Copy of project execution plan includes requirements to minimise lighting where practicable.	EPO-DC-02	6.3
Management of support vessel lighting within the operational area at night within 3 km of the shore.	DC-CM-08	Support vessels will be required to minimise deck lights after 9pm and refrain from directing spot lights towards the water or a turtle nesting beach, unless inconsistent with AMSA Marine Orders (such as lighting required to safely accommodate night time cargo lifting operations), to minimise the potential risk of light spill disturbing marine fauna and seabirds.	DC-CM-08-EPS-01	Copy of project execution plan includes requirements to minimise lighting where practicable.	EPO-DC-02	6.3
Fuel oil quality	DC-CM-09	MARPOL-compliant (Marine Order 97) fuel oil (diesel) will be used during the activity.	DC-CM-09-EPS-01	Fuel bunkering records and/or relevant purchase records show that compliant fuel oil was used.	EPO-DC-03 EPO-DC-08	6.4, 7.8
		HFO and IFO will not be stored or used on vessels	DC-CM-09-EPS-02			
International Air Pollution Prevention Certificate	DC-CM-10	Pursuant to Marine Order 97, vessels will maintain a current International Air Pollution Prevention	DC-CM-10-EPS-01	Current International Air Pollution Prevention Certificate	EPO-DC-03	6.4

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		Certificate that certifies that measures to prevent ozone-depleting substance emissions and to reduce nitrogen oxides, sulphur oxides and incineration emissions during the activity are in place.		(if required for the vessel class under Marine Order 97)		
Ozone-depleting substance handling procedures	DC-CM-11	Ozone-depleting substances managed in accordance with Marine Order 97 to reduce the risk of an accidental release of ozone-depleting substances to air.	DC-CM-11-EPS-01	Completed ODS record book or recording system is on the vessel. Incident database records show that there have been no accidental releases of ODS.	EPO-DC-03	6.4
Waste incineration management	DC-CM-12	Waste incineration managed in accordance with Marine Order 97.	DC-CM-12-EPS-01	Completed waste record book or recording system	EPO-DC-03	6.4
Planned subsea and offshore maintenance	DC-CM-13	Detailed permits to work, risk assessments, and all supporting HSE procedures and documentation are prepared for subsea maintenance or inspection, repair and intervention activities, as outlined in the Santos Subsea Inspection Procedure (SO-35-IS-00001).	DC-CM-13-EPS-01	Records demonstrate implementation of the Santos Subsea Inspection Procedure (SO-35-IS-00001) such as: • CMMS records • Risk assessments • Permit to work records	EPO-DC-04 EPO-DC-07 EPo-DC-08	6.5, 7.4, 7.7, 7.10, 7.11
Anchoring and equipment deployment management	DC-CM-14	If anchoring or placement of equipment is required, vessels will anchor or place equipment on seabed only at Santos approved locations in accordance with the Mooring Operations Procedure (QE-91-IT-10001).	DC-CM-14-EPS-01	Anchoring records show that approval was obtained from Santos prior to anchoring.	EPO-DC-04 EPO-DC-08	6.5, 7.7, 7.10, 7.11
		Recovery of all deployed equipment	DC-CM-14-EPS-02	Equipment records show all deployed equipment is recovered.	EPO-DC-04	6.5, 7.10, 7.11
Navigational charting of infrastructure	DC-CM-15	The offshore subsea infrastructure is charted on Australian Hydrographic Service nautical charts.	DC-CM-15-EPS-01	Australian Hydrographic Service nautical charts show Santos' offshore infrastructure is charted	EPO-DC-05 EPO-DC-08	6.6, 7.7, 7.8, 7.10, 7.11
Seafarer certification	DC-CM-16	Vessel crew are trained and competent, in accordance with Marine Order 70, to navigate vessels and reduce interaction with other marine users.	DC-CM-16-EPS-01	Training records show that crew are trained and competent.	EPO-DC-05 EPO-DC-08	6.6, 7.8
Constant bridge watch on support vessels	DC-CM-17	Monitoring of surrounding marine environment undertaken from vessel bridge.	DC-CM-17-EPS-01	Records show that 24 hour bridge watch is maintained	EPO-DC-01 EPO-DC-05	6.6, 7.2
Santos' stakeholder consultation strategy	DC-CM-18	All correspondence with external stakeholders is recorded.	DC-CM-18-EPS-01	Consultation records	EPO-DC-05	6.6

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		Santos' consultation coordinator is contactable before, during and after completion of the planned activity to ensure stakeholder feedback is evaluated and considered during the operational activity phases.	DC-CM-18-EPS-02	Consultation coordination contact details made available to all relevant people in all correspondence.	EPO-DC-05	6.6
		Santos will not restrict commercial fishing access to the operational area and is committed to concurrent operations where safety of either vessel is not compromised.	DC-CM-18-EPS-03	Incident records show nil incidents of complaints of restrictions to commercial fishing access to the operational area, and show nil incidents of vessel safety being compromised by concurrent operations	EPO-DC-05	6.6
No fishing from project vessels	DC-CM-19	Personnel are prohibited from recreational fishing activities on vessels	DC-CM-19-EPS-01	Induction records confirm no fishing prohibition is communicated to all personnel	EPO-DC-05	6.6
Maritime Notices	DC-CM-20	Information provided to either AMSA, Department of Defence, AHO and/or nearest port authority on timing of IMMR activities on the pipeline so the maritime industry is aware of petroleum activities.	DC-CM-20-EPS-01	Transmittal records demonstrate notification of activity prior to the activity commencing	EPO-DC-05	6.6
Sewage system	DC-CM-21	Pursuant to Marine Order 96, support vessels have a current International Sewage Pollution Prevention Certificate which certifies that required measures to reduce impacts from sewage disposal are in place.	DC-CM-21-EPS-01	Current International Sewage Pollution Prevention Certificate	EPO-DC-03	6.7
		Preventive maintenance on sewage treatment equipment is completed as scheduled.	DC-CM-21-EPS-02	Vessels have records that demonstrate that maintenance is performed as per the vessel's planned maintenance system requirements.		
		Sewage from vessels is not discharged in State Waters, in accordance with Marine Order 96.	DC-CM-21-EPS-03	Records demonstrate that sewage was appropriately retained		
Marine Assurance Procedure	DC-CM-22	Vessels selected and on-boarded in accordance with the Offshore Marine Assurance Procedure (SO-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP	DC-CM-22-EPS-01	Completed documentation in accordance with procedure.	EPO-DC-03 EPO-DC-08	6.7, 7.8

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
Oily mixture system	DC-CM-23	Oily mixtures (bilge water) only discharged to sea in accordance with Marine Order 91.	DC-CM-23-EPS-01	Oil record book is maintained	EPO-DC-03	6.7
		Preventive maintenance on oil filtering equipment completed as scheduled.	DC-CM-23-EPS-02	Vessels have records that demonstrate that maintenance is performed as per the vessel's planned maintenance system requirements.		
		Pursuant to Marine Order 91, support vessel larger than 400 t will have an International Oil Pollution Prevention Certificate, which certifies that required measures to reduce impacts of planned oil discharges are in place.	DC-CM-23-EPS-03	Current International Oil Pollution Prevention Certificate		
Waste (garbage) management procedure	DC-CM-24	Waste management procedure implemented to reduce the risk of unplanned release of waste to sea in accordance with Marine Order 95. Garbage generated on vessels will not be disposed to the marine environment. The plan includes detail for: • Bin types • Lids and covers • Waste segregation • Bin storage • Food waste.	DC-CM-24-EPS-01	Garbage record book is maintained Audit records show that garbage management plan is implemented Inspection records show that garbage management plan is implemented	EPO-DC-03 EPO-DC-07	6.7, 7.3
		Pursuant to MARPOL Annex V, placards displayed to notify personnel of waste disposal restrictions.	DC-CM-24-EPS-02	Audit records show that placards are displayed Inspection records show that there are regular checks of placards being displayed	EPO-DC-03	6.7
		Discharge of putrescible waste not permitted within EP operational area (i.e. <3 nm from land)	DC-CM-24-EPS-03	Completed garbage disposal record book or recording system verified by Santos CSR Marine assurance inspections to confirm compliance with Waste (garbage) management procedure.	EPO-DC-03	6.7

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
Deck cleaning product selection	DC-CM-25	Deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to Marine Order 94.	DC-CM-25-EPS-01	Safety data sheet and product supplier supplementary data are retained as required	EPO-DC-03	6.7
Chemical selection procedure	DC-CM-26	Production or process chemicals potentially discharged to sea are Gold-, Silver-, D-, or E-rated through the Offshore Chemical Notification Scheme, or are PLONOR (pose little or no risk) substances listed by the OSPAR Commission, or have a complete risk assessment as per Santos' Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) so that only environmentally acceptable products are used.	DC-CM-26-EPS-01	Records show completed Santos chemical risk assessments demonstrating implementation of the Santos Operations Chemical Section, Evaluation and Approval Procedure (EA-91-11-10001)	EPO-DC-03 EPO-DC-07	6.7, 6.8, 7.4, 7.10
General chemical management procedures	DC-CM-27	Safety data sheet available for all chemicals to aid in the process of hazard identification and chemical management.	DC-CM-27-EPS-01	Inspection records show that SDS are retained on the vessel	EPO-DC-03 EPO-DC-07	6.7, 6.8, 7.3, 7.4. 7.10
		Chemicals managed in accordance with the safety data sheet in relation to safe handling and storage, spill-response and emergency procedures, and disposal considerations.	DC-CM-27-EPS-02	Audit records demonstrate compliance with SDS Inspection records demonstrate compliance with SDS		
Scupper plugs will be available for deployment in the event of a spill to prevent deck drainage.	DC-CM-28	Scupper plugs or equivalent deck drainage control measures available where hydrocarbons are stored and frequently handled.	DC-CM-28-EPS-01	Completed weekly inspection checklist demonstrates that scupper plugs are on board	EPO-DC-03 EPO-DC-07	6.7, 6.8, 7.4
Pipeline flushing prior to replacement and repair activities on the pipeline.	DC-CM-29	Pipeline is flushed to reduce hydrocarbon content prior to replacement and repair activities on the pipeline.	DC-CM-29-EPS-01	Completed operational records show that the system was flushed to reduce hydrocarbon content prior to replacement and repair activities on the pipeline	EPO-DC-03	6.8
Vessel spill response plan (SOPEP/SMPEP)	DC-CM-30	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP), which outlines steps taken to combat spills.	DC-CM-30-EPS-01	Audit records demonstrate compliance with the SOPEP Inspection records demonstrate implementation of the SOPEP	EPO-DC-03 EPO-DC-07 EPO-DC-08	6.8, 7.4, 7.8
		SOPEP or SMPEP spill response exercises conducted at least every three months to ensure personnel are prepared.		Spill exercise records or evidence of a spill exercise in an operational report demonstrate compliance with schedule		

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
Implementation of the management controls within the Santos Invasive Marine Species Management Plan	DC-CM-31	Vessels are managed to low risk in accordance with the Santos Invasive Marine Species Management Plan (EA-00-RI-10172) and consistent with the IMO 2023 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines 2023) prior to movement or transit into or within the invasive marine species management zone, which requires: • assessment of applicable vessels using the IMSMP risk assessment; and • management of immersible equipment to low risk.	DC-CM-31-EPS-01	Completed risk assessment demonstrating equipment and vessels are 'low risk'.	EPO-DC-06	7.1
		Pursuant to the *Biosecurity Act 2015* and Australian Ballast Water Management Requirements 2020, primary and support vessels carrying ballast water and engaged in international voyages shall manage ballast water so that marine pest species are not introduced.	DC-CM-31-EPS-02	Records show Ballast Water Management is implemented Completed ballast water record book or log is maintained and current.	EPO-DC-06	
		Vessels receive entry clearance from DAWE (Seaports) as necessary (or as applicable to their location and movements).	DC-CM-31-EPS-03	Records show a complete Questionnaire for Biosecurity Exemptions for Biosecurity Control Determination issued to Seaports at least one month in advance where practicable	EPO-DC-06	
Anti-foulant system	DC-CM-32	Anti-foulant systems are maintained in compliance with International Convention on the Control of Harmful Anti-Fouling Systems on Ships.	DC-CM-32-EPS-01	Current International Anti-Fouling System Certificate.	EPO-DC-06	7.1
Dropped object prevention procedures	DC-CM-33	Vessel Safety Case and Implementation of the Santos WA Offshore Oil & Gas Assets Lifting Guidelines (7700-670-STN-0006) which includes the following controls: • Lifting equipment certification and inspection • Lifting crew competencies • Heavy-lift procedures • Preventive maintenance on cranes.	DC-CM-33-EPS-01	DEMIRS-accepted Safety Case. Completed inspection checklist Details contained in incident documents	EPO-DC-07 EPO-DC-08	7.3, 7.4, 7.7, 7.11
		Lifting operations managed in accordance with Vessel work instructions or procedures.	DC-CM-33-EPS-02	Vessel work instructions or procedures.	EPO-DC-07 EPO-DC-08	7.3, 7.4, 7.7

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		Objects dropped overboard are recovered (if possible) to mitigate the environmental consequences from objects remaining in the marine environment, unless the environmental consequences are negligible, or safety risks are disproportionate to the environmental consequences.	DC-CM-33-EPS-03	Fate of dropped objects detailed in incident documents.	EPO-DC-07 EPO-DC-08	7.3, 7.4, 7.7
Hazardous chemical management procedures	DC-CM-34	For hazardous chemicals, including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: • Storage containers closed when the product is not being used • Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak • Storage containers labelled with the technical product name as per the Safety Data Sheet (SDS) • Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up • Storage bunds and drip trays do not contain free flowing volumes of liquid • Spill response equipment readily available.	DC-CM-34-EPS-01	Audit records demonstrate compliance with the hazardous chemical standards. Inspection records demonstrate compliance with the hazardous chemical standards.	EPO-DC-07	7.3, 7.4
Santos Refuelling and Chemical Transfer Standard (SO 91 IQ 00098)	DC-CM-35	Bunkering activities follow the requirements of the Santos Refuelling and Chemical Transfer Standard (SO-91-IQ-00098) which includes key requirements to prevent spills to the environment such as: • when bunkering activities can occur • roles and responsibilities • dry-break couplings and breakaway couplings used • bunkering activity communication requirements • bunker hose undergoes hydrostatic leak testing.	DC-CM-35-EPS-01	Completed bunkering checklist Spills details contained in incident documentation.	EPO-DC-07 EPO-DC-08	7.3, 7.4, 7.8
Maritime Dangerous Goods Code	DC-CM-36	Dangerous goods managed in accordance with IMDG Code to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	DC-CM-36-EPS-01	Completed Multimodal Dangerous Goods Form for OSV transfers Completed inspection checklist	EPO-DC-07	7.4

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
ROV inspection and maintenance procedures	DC-CM-37	Preventive maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea.	DC-CM-37-EPS-01	Vessels have records that demonstrate that ROV maintenance is performed as per the ROVs planned maintenance system requirements.	EPO-DC-07	7.4
		ROV pre-deployment inspection completed to reduce the risk of hydraulic fluid releases to sea.	DC-CM-37-EPS-02	Completed pre-deployment inspection of hose integrity		
Permit to work system	DC-CM-38	All hot work and isolation activities undertaken in accordance with SCMS-03: Permit to Work in the process areas are carried out under a Permit to Work System and changes are managed under the Change Management Control System.	DC-CM-38-EPS-01	Site records e.g. permit to work audits	EPO-DC-01 EPO-DC-10	7.5
Emergency response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	DC-CM-39	In the event that the integrity of a pipeline/valve is compromised or there is an unplanned hydrocarbon release from the Devil Creek Pipeline the Devil Creek Emergency Response Plan (DC-40-IF-00096) is initiated to activate the isolation of the flowline/ pipeline/ wells.	DC-CM-39-EPS-01	Devil Creek Emergency Response Plan (DC-40-IF-00096) CMMS records.	EPO-DC-01 EPO-DC-08 EPO-DC-09 EPO-DC-10	7.5, 7.7, 7.9
Engineering change management procedure	DC-CM-40	Changes to equipment and controls are defined and assessed in accordance with the CMC Procedure (SMS-OES-OS02-PD04) before they are approved and implemented.	DC-CM-40-EPS-01	Records of CMC.	EPO-DC-01 EPO-DC-10	7.5
Inspection of hydrocarbon-containing equipment	DC-CM-41	Subsea assets will meet the inspection criteria and frequency specified in Santos' Subsea Inspection Procedure (SO-35-IS-00001), the purpose of which is to describe the inspection philosophy, procedure and reporting requirements for Santos subsea assets.	DC-CM-41-EPS-01	Vessels have records that demonstrate that inspections are performed as per the Subsea Inspection Procedure (SO-35-IS-00001)	EPO-DC-08	7.7
Testing and maintenance of ESD systems and shutdown or safety valves	DC-CM-42	Emergency shutdown systems and shutdown or safety valves are routinely tested and maintained to ensure integrity and function is maintained. Their testing criteria and test frequency are specified in: • PS-06 ESD and Blowdown: Emergency Shutdown Valves (DC-00-RG-00027), which prevents the escalation of major accident events by isolating the process plant and/or utility equipment	DC-CM-42-EPS-01	Records demonstrate maintenance and testing is performed as per the planned maintenance system requirements.	EPO-DC-08 EPO-DC-09	7.7, 7.9

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		• PS-08 ESD and Blowdown: Safety Instrumented Systems (DC-00-RG-00029), which applies to the logic solver modules holding the safety logic • PS-10 ESD and Blowdown: Pressure Safety Valves (DC-00-RG-00031), which applies to all pressure safety valves on pressure-containing equipment and pipework to prevent a loss of containment from equipment and piping by controlled disposal via the flare systems or an alternative safe location.				
Accepted Oil pollution emergency plan (OPEP)	DC-CM-43	In the event of an oil spill to sea, the Santos OPEP requirements implemented to mitigate environmental impacts.	DC-CM-43-EPS-01	Incident database records show that oil spill to see are responded to in accordance with the OPEP.	EPO-DC-08 EPO-DC-09	7.7, 7.8, 7.9
		Spill response exercises conducted in accordance with the OPEP.	DC-CM-43-EPS-02	Spill exercise records or evidence of a spill exercise in an operational report demonstrate compliance with schedule		
DEMIRS accepted safety case	DC-CM-44	A DEMIRS-accepted OPMP/safety case for all licensed pipelines is in place to specifically manage the risks associated with operation and integrity including maintenance activities.	DC-CM-44-EPS-01	DEMIRS-accepted OPMP/safety case	EPO-DC-07 EPO-DC-08 EPO-DC-09	7.7, 7.9, 7.11
Inspection and corrosion monitoring	DC-CM-45	Pipelines meet inspection and monitoring criteria and frequency outlined in PS-03 Hydrocarbon Containment; Risers and Pipelines (DC-00-RG-00024), which manages the inherent safety of risers and pipelines, including all mounted fittings, fixtures and supports.	DC-CM-45-EPS-01	Records demonstrate that pipeline maintenance is performed as per the pipelines planned maintenance system requirements.	EPO-DC-07 EPO-DC-08 EPO-DC-09	7.7, 7.9, 7.10, 7.11
		Onshore pipelines meet inspection and monitoring criteria and frequency outlined in: • PS-01 Structural Integrity (onshore: DC-00-RG-00022) • PS-02 Hydrocarbon Containment: Hydrocarbon-Containing Equipment (onshore: DC-00-RG-00023) • PS-03 Hydrocarbon Containment: Risers and Pipelines (onshore: DC-00-RG-00024) • PS-06 ESD and Blowdown: Emergency Shutdown Valves (onshore: DC-00-RG-00027)	DC-CM-45-EPS-02	Records demonstrate that pipeline maintenance is performed as per the pipelines planned maintenance system requirements.	EPO-DC-07 EPO-DC-08 EPO-DC-09	7.7, 7.9, 7.10

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
		• PS-08 ESD and Blowdown: Safety Instrumented Systems (onshore: DC-00-RG-00029) • PS-10 ESD and Blowdown: Pressure Safety Valves (onshore: DC-00-RG-00031).				
Onshore Pipeline Inspection Procedure	DC-CM-46	As per the Onshore Pipeline Inspection Procedure (OP-14-IG-0001) surveillance via ground or aerial pipeline Right of way/Easement are carried out in compliance with Pipelines, Gas and Liquid Petroleum Act, Part 3- Operations and Maintenance AS-2885.3. Inspection includes the discovery of undetected damage noting indication of leaks such as dead vegetation or evidence of liquid.	DC-CM-46-EPS-01	Pipeline Inspection Procedure (OP-14-IG-0001)	EPO-DC-09	7.9
Fully enclosed structure for abrasive blasting (blasting chamber)	DC-CM-47	As per the Environmental Protection (Abrasive Blasting) Regulations 1998, abrasive blasting will be carried out in a sealed blasting chamber to prevent dust escaping unless a chamber cannot be used due to the size, shape, position or location of the object being blasted.	DC-CM-47-EPS-01	Records demonstrate a sealed blasting chamber is used in accordance with requirements.	EPO-DC-07	7.10, 7.11
Pipeline flushing prior to opening of the subsea system.	DC-CM-48	Subsea system flushed to reduce hydrocarbon content prior to opening of the subsea system.	DC-CM-48-EPS-01	Completed operational records.	EPO-DC-07	7.10, 7.11
Calibrated dosing system in place to ensure accuracy of chemical dosing	DC-CM-49	Correct calibration of chemical dosing system is confirmed in accordance with Santos temporary equipment assessment procedure (SO-91-IG-10050)	DC-CM-49-EPS-01	Project execution procedure	EPO-DC-07	6.8, 7.10,
Testing of pipeline preservation fluids	DC-CM-50	Pipeline preservation fluids will be checked every 6 months during the preservation period to ensure the effectiveness of the preservation fluid	DC-CM-50-EPS-01	Project execution procedure	EPO-DC-07	7.10
Pipeline is positively isolated at minimum pressure	DC-CM-51	Pipeline is positively isolated in accordance with the Isolation manual 1541-012-WPR-0039 and kept at minimum pressure.	DC-CM-51-EPS-01	CMMS records	EPO-DC-07	7.10
Activate the relevant scientific monitoring plans as per the operational and scientific services arrangement in place in the OPEP	DC-CM-52	In the event that the integrity of a pipeline/valve is compromised or there is an unplanned release of treated seawater from the DC supply pipeline, the scientific monitoring plans will be activated as per arrangements in the Devil Creek Pipeline and WHP OPEP.	DC-CM-52-EPS-01	Devil Creek Pipeline and WHP OPEP. CMMS records	EPO-DC-07	7.10

Control Measure	Control Measure Ref No.	Environmental Performance Standard	EPS Ref. No.	Measurement Criteria	EPO Ref. (Table 8-1)	Relevant EP Section
Reporting of GHG emissions as per the NGER Scheme.	DC-CM-53	NGERS reporting is lodged as per the Clean Energy Regulator requirements.	DC-CM-53-01	Reporting records.	EPO-DC-03	6.4
Terrestrial fauna sightings in the operational area are recorded during operations and IMMR activities if they have potential to interact with personnel or activities.	DC-CM-54	Terrestrial fauna sighting in operational area during operations and IMMR activities with the potential to interact with personnel or activities are recorded in a fauna sighting register	DC-CM-54-01	Sighting records	EPO-DC-01	7.5

8.5 Leadership, accountability and responsibility

P(SL)(E)R 2012 Requirements
Regulation 15(4)
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.

While the Santos Chief Executive Officer (CEO) has the overall accountability for the implementation of the Santos Management System and Santos Environment Health and Safety Policy, the Reindeer WHP and DC Supply Pipelines sit under the remit of the Executive Vice President of WA, Northern Australia, Timor Leste Business Unit. The Production Manager VI/DC is accountable for ensuring implementation, management, and review of this CoP EP.

Key roles and environmental responsibilities for this activity are detailed in Table 8-3and will be communicated to these positions before the activity commences and when any changes are made to these positions.

They are also outlined in the OPEP for oil spill response.

Table 8-3: Chain of command, key leadership roles and responsibilities

Role	Responsibilities
Executive Vice President Western Australia (WA), Northern Australia (NA) & Timor Leste (TL)	• Accountable for HSE at Santos operated WA, NA and TL facilities • Approving budgets to meet EP commitments •
Production Manager – VI/DC	• Accountable for compliance with all internal and external regulatory requirements including the overall management and implementation of the Santos Management System • Ensuring overall compliance with the EP with advice and guidance from the Santos Environmental Coordinator • Ensuring the appropriate level of budget planning and resources is in place to meet EP commitments • Ensuring appropriate checks completed prior to mobilising support vessels • Approving environmental MoC documents • Ensure incidents and non-conformances are managed as per Sections 8.11 and 8.15.5 respectively. • Ensuring company has contractual provisions in place to enable rapid response to oil spill incidents.
GM Projects and Decommissioning-during COP phase only	Has overall responsibility for: • Ensuring overall compliance with the EP with advice and guidance from the Santos Environmental Coordinator • Compliance with Decommissioning strategy • Planning decommissioning contracting and execution strategy • Approving resources to meet decommissioning requirements • Ensuring relevant Santos Management System Standards and procedures are implemented as necessary. • Ensuring the appropriate level of budget planning and resources is in place to meet EP commitments • Ensuring appropriate checks completed prior to mobilising support vessels • Approving environmental MoC documents • Ensure incidents and non-conformances are managed as per Sections 8.11 and 8.15.5 respectively.

Role	Responsibilities
Offshore Installation Manager (OIM) – Operations only	Has overall responsibility for: • Implementing EP commitments • Ensuring personnel competency • Ensuring compliance with procedures and work instructions • Being the site focal point for onshore/offshore communications • Approving vessels entering the field • Reporting all incidents and potential hazards • Leading site-based incident response • Implementing corrective actions arising from environmental incidents and audits
HSS Manager WA NA & TL	Has overall responsibility for: • Ensuring incident preparedness and response arrangements meet Santos and regulatory requirements • Approving the OPEP • Providing ongoing resources to maintain compliance with the OPEP and other Santos incident response requirements
HSS Team Lead	Has overall responsibility for: • Overarching incident and crisis management responsibility • Manage the CMT and IMT personnel training program • Review and assess competencies for CMT, IMT, and field-based IRT members • Manage the Duty roster system for CMT and IMT personnel • Manage the maintenance and readiness of incident response resources and equipment
Manager Approvals (WA, NA, TL)	Has overall responsibility for: • Ensuring adequate resources are in place to meet environment compliance requirements within the EP • Providing support and advice to the Environment Coordinator (Compliance) as needed • Notifying DEMIRS of a change in titleholder, a change in the titleholder's nominated liaison person or a change in the contact details for (as per Section 1.5).
Santos Offshore Representative or Company Site Representative	Has overall responsibility for: • Being responsible for day-to-day monitoring of operations. • Interface with the Production Manager or GM Decommissioning and projects and assist the contractor in performing field campaigns in a safe and environmentally acceptable manner in accordance with this EP. • Ensuring all personnel are given a full briefing/induction on environmental sensitivities of the permit area and environmental management procedures and commitments detailed in this EP. • Ensuring Santos Environment, Health and Safety Policy is applied in areas of responsibility. • Maintaining clear communication between Santos and contractors on environmental issues. • Notifying Production Manager or GM Decommissioning immediately of any changes in operations which could impact negatively on environmental performance. • Ensuring incident investigations are conducted as required. • Participating in the investigation of any environmental incidents. • Being responsible for the offshore management of contractor activities and ensuring compliance with the relevant commitments (including record keeping) made in this EP. • Being offshore focal point for communications between Santos and contractor personnel. Immediately report any incidents to the Vessel Master and Production Manager or GM Decommissioning

Role	Responsibilities
Senior Project Engineer (COP)	Has responsibility for: • Supporting Production Manager VI/DC • Ensure relevant Santos Management System Standards and procedures are implemented as necessary. • Ensure adequate resources are in place to meet the requirements within the EP and OPEP. • Ensure adequate emergency response capability is in place. • Interface with the Production Manager (or delegated representative) and assist the contractor in performing field campaigns in a safe and environmentally acceptable manner in accordance with this EP. • Ensure incidents and non-conformances are managed as per Sections 8.11 and 8.15.5 respectively. • Review information received from external sources regarding lessons learnt and non-conformances, relevant to the survey, with the project team to identify if there are actions relevant to the survey. If actions are relevant implement as per Section 8.16 • Implementing CMMS • Preparing work scopes for preservation activities • Management of preservation activities Ensuring risk assessments have been completed
Senior Project Engineer (decommissioning)	Has responsibility for: • Supporting GM Decommissioning • Ensure relevant Santos Management System Standards and procedures are implemented as necessary. • Ensure adequate resources are in place to meet the requirements within the EP and OPEP. • Ensure adequate emergency response capability is in place. • Ensure overall compliance with the EP and OPEP with advice and guidance from the Santos Environmental Coordinator / HSE Manager as necessary. • Interface with the GM Decommissioning (or delegated representative) and assist the contractor in performing field campaigns in a safe and environmentally acceptable manner in accordance with this EP. • Ensure incidents and non-conformances are managed as per Sections 8.11 and 8.15.5 respectively. • Review information received from external sources regarding lessons learnt and non-conformances, relevant to the survey, with the project team to identify if there are actions relevant to the survey. If actions are relevant implement as per Section 8.16. • Implementing CMMS. • Ensuring risk assessments have been completed. Scoping and implementation of decommissioning engineering studies.
Santos Environmental Coordinator (Compliance)	Has responsibility for: • Ensuring site environmental audits are carried out as required to ensure compliance. • Ensuring environmental monitoring is conducted in accordance with the Santos Management System and this EP. • Liaising with the Santos Production Manager and Offshore Site Representative to ensure compliance with all aspects of this EP. • Performing environmental education and inductions for operational personnel. • Ensuring incident investigations are conducted as per Santos Management System. • Ensuring EP compliance report that covers environmental performance of the activity in this EP is prepared and submitted to DEMIRS.
Senior Environmental Advisor	Has overall responsibility for: • Complying with Santos' Environmental Management Policy and this EP • Preparation of environmental approval documentation for the DC pipelines • Scoping of environmental monitoring scopes • Review of Ep as required in line with MOC process

Role	Responsibilities
Senior Stakeholder Adviser / Relevant Persons Coordinator	• Responsible for implementation of steps described in Section 8.17 • 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 the EP • Maintains records of all Relevant Persons correspondence specific to the EP • Ensures relevant stakeholders are identified throughout the life of the EP • Prior to commencement of the activity and on advice of Environment Manager, WA, NA, TL , provides a notification to all relevant stakeholders listed, or as revised, Table 8-4 The notification will include information on activity timing, vessel movements and vessel details. • On advice of Santos Environmental Coordinator (Compliance), provide cessation notifications to relevant stakeholders identified in Table 8-4. • Is available before, during and after the activity to ensure opportunities for stakeholders to provide feedback are available. • Prepares and distributes quarterly consultation updates to relevant
Senior Oil Spill Response Advisor	Has overall responsibility for: • Providing upfront and ongoing guidance, framework, and direction on preparation of this OPEP • Developing and maintaining arrangements and contracts for incident response support from 3rd-parties • Developing and defining objectives, strategies and tactical plans for response preparedness defined in this OPEP and IRP • Undertaking assurance activities on arrangements outlined within the OPEP
Support Vessel Masters	Has overall responsibility for: • Implementing and ensuring compliance with relevant environmental legislative requirements, EP commitments and operational procedures on the support vessel • Maintaining clear communication with the crew and passengers • Communicating hazards and risks to the workforce • Monitoring daily activities on the vessel to ensure the relevant environmental legislative requirements, EP commitments and operational procedures are being followed • Maintaining their vessel to all regulatory and class requirements • Maintaining their vessel in a state of preparedness for emergency response • Reporting environmental incidents to the Person in Charge and ensuring follow-up actions are carried out.
All personnel	Adhere to this EP. • Follow good housekeeping procedures and work practices. • Report HSE incidents, hazards or non-conformance to the OIM in a timely manner. Report sightings of marine fauna and pollution.

8.6 Workforce training and competency

8.6.1 Activity inductions

All personnel that work on the DC sales gas pipeline onshore and crew on support vessels working on the DC supply pipeline (onshore and offshore) will complete an induction that will include a component addressing their EP responsibilities. Induction attendance records for all personnel will be maintained. Inductions will include information on:

- Santos Environment, Health and Safety Policy
- Regulatory regime (DEMIRS regulations)
- EPBC Policy Statement 2.1 (in relation to geophysical survey activities)
- Operating environment (e.g. nearby protected marine areas, sensitive environmental periods, speed limits)
- Interaction with other marine users (i.e. topic to reinforce the importance of marine communications regarding any potential interactions with active commercial fishing)

- Marine fauna observation protocols
- Activities with highest risk (e.g. IMS and hydrocarbon releases)
- EP commitments (e.g. Table 8-2)
- Incident reporting and notifications
- Regulatory compliance reporting
- Key environmental management requirements (e.g. Marine Fauna Interaction)
- Management of change process for changes to EP activities
- Oil pollution emergency response (e.g. OPEP requirements).

8.6.2 Training and competency

All members of the workforce on the DC sales gas pipeline onshore or support vessels offshore working on the DC supply pipeline will complete relevant training and/or hold relevant qualifications and certificates for their role. Santos and its contractors (e.g. support vessels and technical service providers) are individually responsible for ensuring their personnel are qualified and trained. The systems, procedures and responsible persons will vary and will be managed through the use of online databases, staff on-boarding process and training departments.

Trained Crew undertaking marine fauna observations prior to survey commencement using geophysical equipment must have proven experience in whale observation, distance estimation and reporting (as per Part A2 of EPBC Act Policy Statement 2.1, noting that the Policy Statement allows for a trained crew member to undertake this role as opposed to a Marine Mammal Observer)).

Personnel qualification and training records will be sampled at various times such as during the procurement process, inductions, crew change, and operational inspections and audits.

8.6.3 Workforce involvement and stakeholder communication

Daily operational meetings will be held at which HSE will be a standing agenda item. It is a requirement that supervisors attend daily operational meetings and that all personnel attend daily toolbox or pre-shift meetings. During the preservation phase the DC pipelines will be managed from VI and daily meetings will be held with DC and HSE as agenda items

Toolbox or pre-shift meetings will be regularly held offshore to plan jobs and discuss work tasks, including HSE risks and controls.

HSE performance will be monitored and reported during the activity, and performance metrics (such as the 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 in water).

Ongoing stakeholder management strategies are discussed in Section 4.

8.7 Maintenance management system

Santos uses a Computerised Maintenance Management System (CMMS) for offshore and onshore plant maintenance and inspection activities. The objective of the Maintenance Management System is to ensure that the plant and associated equipment are fit for purpose, are safe to operate and are environmentally compliant for the life of the asset.

In addition to the scheduling of routine maintenance activities and inventory control, the Santos CMMS provides the information required to determine risk or criticality-based maintenance requirements. This analysis matches the maintenance and inspection type and frequency to the criticality of the equipment and also allows efforts to be prioritised in the areas most critical for safety, environment, compliance and production. This results in effective and efficient practices to maximise reliability and availability of the plant. For each individual plant and facility, a preventive maintenance plan is incorporated into the CMMS. The preventive maintenance plan includes:

- All routine inspections
- All statutory inspections
- All maintenance carried out on a usage basis such as machine running hours.

8.8 Information management and document control

This EP and the associated Oil Pollution Emergency Plan (OPEP), as well as any approved MoC documents (Section 8.9), are controlled documents and current versions will be available on the Santos document control system. Santos contractors vessels are also required to maintain current versions of Santos' HSE documents including the EP and OPEP on their vessels.

Environmental performance objectives and standards will be measured based on the measurement criteria listed in Table 8-2. Such records will be maintained for a period of five years. Contractors are required to make these records available upon request.

8.9 Management of change

Proposed changes to this EP and OPEP will be managed in accordance with the Santos Environment Management of Change Procedure (EA-91-IQ-10001). The MoC process provides a systematic approach to initiate, assess, document, approve, communicate and implement changes to EPs and OPEPs.

The MoC process considers Regulations 7, 8 and 18 of P(SL)(E)R 2012 and determines whether and in what manner a proposed change can proceed. The MoC procedure will determine whether a revision of the EP is required and whether that revision is to be submitted to DEMIRS. If a revision of the EP is not required, the MoC form will detail the basis for the decision and if a bridging document or written notification is required for submission and acceptance to DEMIRS prior to the activity commencing. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be ALARP and acceptable. Additional stakeholder consultation may be required depending on the nature and scale of the change. Additional information on the MoC process is provided in Figure 8-1.

The MoC procedure also allows the assessment of new information that may become available post EP acceptance. For example, new management plans for marine reserves, recovery plans or conservation advice for species and changes to the EPBC Act Protected Matters Search results. If review identifies new information, this is treated as 'Change that has an impact on Environment Plan' in Figure 8-1, and the MoC procedure is followed accordingly.

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 control measure or environmental performance standard changes are communicated to the workforce and implemented. Any MoC will be distributed to the management people identified in Table 8-3 (as appropriate); and the most relevant management position will ensure the MoC is communicated and implemented, which may include crew meetings, briefings or communications as appropriate for the change.

A written notification may be appropriate for temporary or short-term modifications to an existing approved activity where there are no additional or increased environmental risks or impacts.

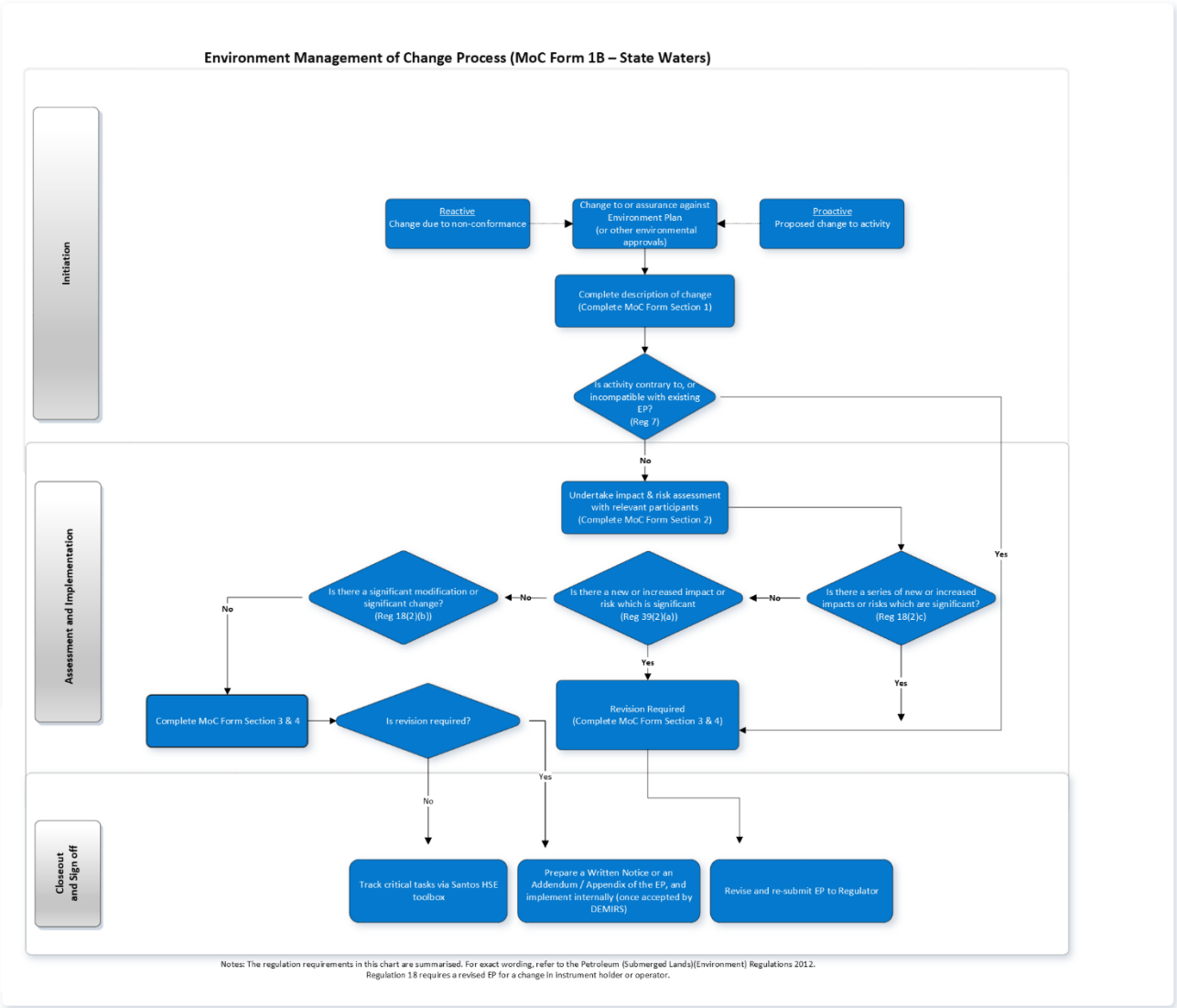


Figure 8-1: Environment management of change process

8.10 Emergency preparedness and response

P(SL)(E)R 2012 Requirements
Regulation 15(10)
The implementation strategy must include an oil spill contingency plan that: a) Sets out details of the following: (iii) Preparations to be made for the possibility of an oil spill; (iv) Emergency response arrangements to be implemented if an oil spill occurs; (v) Recovery arrangements to be implemented if an oil spill occurs; (vi) Current oil spill trajectory modelling that applies to the petroleum activity. and b) Requires the operator to conduct tests of the emergency response arrangements set out in the oil spill contingency plan at specified intervals; and c) Describes the tests mentioned in paragraph (b).

Vessels are required to have and 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) are carried out to refresh the crew in using equipment and implementing incident response procedures.

Santos will implement the Reindeer and Devil Creek Oil Pollution Emergency Plan (EA-14-RI-10001.02) in the event of hydrocarbon spills. The OPEP details how Santos will prepare and respond to a spill event and meets the requirement of Regulation 15(10) P(SL)(E)R 2012 and Regulation 15(8) PP(E)R 2012.

8.11 Incident reporting, investigation and follow-up

P(SL)(E)R 2012 Requirements
Regulation 17(1)
The environment plan must include the following: c) A list of all incidents that are classified as reportable incidents in relation to the petroleum activity.
Regulation 17(2)
The environment plan must classify an incident as a reportable incident if: a) It could arise from the petroleum activity; and b) It has the potential to cause an environmental impact that is classified, under the environmental risk assessment process described in the environment plan, as moderate or more serious than moderate.

All personnel will be informed through inductions and daily operational meetings of their duty to report HSE incidents and hazards. Reported HSE incidents and hazards will be shared during daily operational meetings, and HSE incidents and hazards will be documented in the incident management systems and managed in accordance with the Incident Reporting, Investigation and Learning (SMS-HSS-OS07-PD01). Significant HSE incidents will be investigated using root cause analysis.

Environmental recordable and reportable incidents will be reported to DEMIRS, and other regulators as required, in accordance with Table 8-4.

The incident reporting requirements will be provided to all crew on board vessels or undertaking work on the onshore DC supply and sales gas pipelines with special attention to the reporting timeframes to provide for accurate and timely reporting.

For the purposes of this activity, in accordance with P(SL)(E)R 2012 (Regulation 4: Terms used):

- A recordable incident is an incident that breaches an environmental performance objective or standard in the approved Environmental Plan for the activity.
- A reportable incident is an incident that has caused, or has the potential to cause, an adverse environmental impact and that environmental impact is categorised as “moderate” or “more serious than moderate”, without standard controls in place.
- In accordance with Section 4.2.1 of DEMIRS Guideline for the Development of Petroleum, Geothermal and Pipeline Environment Plans in Western Australia, Santos environmental and operations personnel conducted a

specific Consequence workshop on 24 June 2024, to assess the consequence of both planned and unplanned events without controls in place.

Santos will report any of the following incidents as a reportable incident in accordance with Table 8-4:

- Uncontrolled release of hydrocarbons or environmentally hazardous chemicals more than 80 L to the marine environment;
- Detection of a marine pest species during an activity
- Accidental disturbance to sensitive benthic habitat, being a coral reef or bommie
- Death or injury of protected marine fauna where the death or injury was caused or suspected to have been caused by the activity; and
- Unplanned impact caused to a matter of National Environmental Significance (NES) during an activity (as per the EPBC Act).

8.12 Regulatory notifications

P(SL)(E)R 2012 Requirements
Regulation 16
The environment plan must include arrangements for: a) monitoring, and recording information about, the petroleum activity that are sufficient to enable the Minister to determine whether: i the environmental performance objectives and environmental performance standards in the environment plan have been met; and ii the implementation strategy in the environment plan has been complied with; and b) reporting to the Minister on the information recorded under paragraph (a) at intervals agreed with the Minister, but not less often than annually.

Regulatory, other notification and compliance reporting requirements are summarised in Table 8-4.

Table 8-4: Activity notification and reporting requirements

Initiation	Required Information	Timing	Type	Recipient
Before the Activity				
Department of Defence Standing arrangement with DoD	Activity timing, location, description, and vessel contact details. Confirm restricted air space status.	At least five weeks before the activity commences where practicable.	Written	DoD: offshore.petroleum@defence.gov.au
AFMA Standing arrangement with AFMA	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	AFMA: petroleum@afma.gov.au
AHO Notification Standing arrangement with AHO	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	AHO: datacentre@hydro.gov.au
DAFF Standing arrangement with DAFF	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	DAFF: Petroleum&Fisheries@agriculture.gov.au
DCCEEW Standing arrangement with DCCEEW	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	DCCEEW: Petroleum&Fisheries@agriculture.gov.au
DPIRD This is a standing arrangement with DPIRD	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	DPIRD: Environment@dpird.wa.gov.au
RecFishWest As requested during consultation	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	RecFishWest: info@recfishwest.org.au
WAFIC Standing arrangement with WAFIC	Activity timing, location, description, and vessel contact details.	At least four weeks before the activity commences where practicable.	Written	WAFIC: oilandgas@wafic.org.au
DEMIRS Standing arrangement with DEMIRS.	Activity timing, location, description, and vessel contact details.	At least ten days before the activity commences where practicable.	Written	DEMIRS
AMSA JRCC Standing arrangement with AMSA JRCC.	Activity timing, location, description, and vessel contact details.	24 to 48 hours before the activity commences.	Written	AMSA's JRCC: rccaus@amsa.gov.au

Initiation	Required Information	Timing	Type	Recipient
Tuna Australia This is a standing arrangement with TA.	Activity timing, location, description, and vessel contact details.	24 to 48 hours before the activity commences.	Written	Contact details as provided by Tuna Australia
During the Activity				
AHO Notification As requested during consultation.	Any changes to the intended operations.	As soon as practicable.	Written	AHO: datacentre@hydro.gov.au
Australian Marine Mammal Centre Reporting Any ship strike incident with cetaceans will also 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
AMSA Reporting Under the MoU between Santos and AMSA and as requested by AMSA during consultation.	Any changes to the intended operations.	As soon as practicable.	Written	AMSA's JRCC: rccaus@amsa.gov.au
	Titleholder agrees to notify AMSA of any marine pollution incident [1].	Within two hours of incident.	Oral	AMSA
	POLREP and SITREP available online (refer to OPEP).	POLREP as requested by AMSA following verbal notification. SITREP as requested by AMSA within 24 hours of request.	Written	AMSA
BTAC Requested during consultation	Notification of actual or impending spillage.	As soon as practicable.	As soon as practicable.	BTAC
Department of Biodiversity, Conservation and Attractions Reporting Any harm or mortality to fauna listed as threatened under the WA *Biodiversity Conservation Act 2016*.	Notification of any harm or mortality to fauna listed as a threatened species under the WA *Biodiversity Conservation Act 2016* as a result of Santos' activities. Notification of any incidence of entanglement, boat collisions and stranding of marine mammals in the reserves and any incident of turtle mortality and incidents of entanglement in the reserves as detailed in the Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves.	A fauna report will be submitted to DBCA within seven days to fauna@dbca.wa.gov.au.	Written	DBCA

Initiation	Required Information	Timing	Type	Recipient
Department of Biodiversity, Conservation and Attractions Reporting Notification of the event of a hydrocarbon release.	Notification of actual or impending spillage.	As soon as practicable.	Oral or written	DBCA Pilbara regional office
DCCEEW Reporting Any harm or mortality to EPBC Act listed threatened marine fauna. Marine Fauna Sighting Data.	Notification of any harm or mortality to an EPBC listed species of marine fauna whether attributable to the activity or not.	Within seven days to EPBC.permits@environment.gov.au	Written	DCCEEW
	Marine fauna sighting data recorded in the marine fauna sighting database.	As soon as practicable, in any case no later than three months of the end of the activity.	Written	DCCEEW
DPIRD Reporting If marine pests or disease are suspected this must be reported to DPIRD.	Notification of any suspected marine pests or diseases including any organism listed in the Western Australian Prevention List for Introduced Marine Pests and any other non-endemic organism that demonstrates invasive characteristics.	Within 24 hours.	Oral	DPIRD FishWatch
Department of Transport Reporting All actual or impending MOP incidents that are in, or may impact, State waters resulting from an offshore activity.	Notification of actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment.	Within two hours.	Oral	DoT
	WA DoT POLREP and SITREP available online (refer OPEP).	As requested by DoT after verbal notification.	Written	DoT
Department of Water and Environmental Regulation	Notification of a spill event. Santos will contact DWER on the 24-hour pollution watch hotline 1300 784 782 and email: pollutionwatch@dwer.wa.gov.au	As soon as practicable.	Oral or written	DCCEEW: Petroleum&Fisheries@agriculture.gov.au
Director of National Parks 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; or if any changes to intended	The DNP should be made aware of oil / gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24-hour Marine Compliance Duty Officer on 0419 293 465. The notification should include: • titleholder details	So far as reasonably practicable prior to response action being written.	Oral and written	Director of National Parks

Initiation	Required Information	Timing	Type	Recipient
operations (requested through consultation).	• time and location of the incident (including name of marine park likely to be affected) • proposed response arrangements as per the OPEP (such as dispersant, containment) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator. Note that the DNP may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident.			
	Notify if details regarding the activity change and result in an overlap with or new impact to a marine park.	As soon as practicable.	Written	DNP: marineparks@awe.gov.au
P(SL)(E) Regulation 28 and 29 – Reportable Incident DEMIRS must be notified of any reportable incidents. A reportable incident is defined as: • An incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage.	The oral notification must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out. • 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 two 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	DEMIRS
	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 to petroleum.environment@dmirs.wa.gov.au	Written	DEMIRS National Offshore Petroleum Titles Administrator (NOPTA)
	A written report must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out	Must be submitted as soon as practicable, and in any case not later than three days after the first occurrence of the reportable incident to petroleum.environment@dmirs.wa.gov.au . unless DEMIRS specifies otherwise.	Written	DEMIRS NOPTA

Initiation	Required Information	Timing	Type	Recipient
	• 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.	Same report to be submitted to NOPTA within seven days after giving the written report to DEMIRS.		
P(SL)(E) Regulation 30 – Recordable Incident DEMIRS 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. DEMIRS must also be notified monthly if no recordable incidents have occurred.	Complete Recordable Environmental Incident Monthly Report form. Report will also be completed and submitted to DEMIRS if no recordable incidents have occurred.	As soon as practicable after the end of the calendar month, and in any case, not later than 15 days after the end of the calendar month. The report must be submitted to petroleum.environment@dmirs.wa.gov.au	Written	DEMIRS
P(SL)(E) Regulation 34	Quarterly reporting of emissions and discharges must be provided.	As soon as practicable after the end of the calendar month, and in any case, not later than 15 days after the end of the calendar month. The report must be submitted to petroleum.environment@dmirs.wa.gov.au	Written	DEMIRS
26C and P(SL)(E) Regulation 16 and 34 DEMIRS 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 environmental performance outcomes and standards in the EP have been met. Volumes and details of all emissions and discharges to any land, air, marine, seabed, sub-seabed, groundwater, sub-surface or inland waters environment. The environmental performance reports should include information outlining the scope, a summary of works and operations, environmental performance, review of audits, review of incidents, a review of emissions and discharges, a review of	A detailed environmental performance report for a twelve month period commencing the date of EP acceptance, shall be submitted to DEMIRS within 3 months post reporting timeframe, on annual basis.	Written	DEMIRS

Initiation	Required Information	Timing	Type	Recipient
	chemicals and other substances, monitoring and research, decommissioning and rehabilitation, a review of the environment plan, awareness, training and exercises, and a summary of the consultation involved.			
Santos' commitment to include activity in Quarterly Consultation Update until activity ends.	The Quarterly Consultation Update will include the activity. This consultation will cease once the activity has ended.	Quarterly.	Written	The Quarterly Consultation Update is circulated to a broad group of Santos' stakeholders, including many of the stakeholders identified in Section 6.2.
WAFIC Requested during consultation	Notification of actual or impending spillage. Any changes to the intended operations or unplanned events.	As soon as practicable.	As soon as practicable.	WAFIC: oilandgas@wafic.org.au
WA Museum This is a standing arrangement with DCCEEW.	Notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning.	Within 21 days of the discovery.	Written	DCCEEW Australasian Underwater Cultural Heritage Database at: https://environment.gov.au/shipwreck/public/forms/notification
End of Activity				
AHO AFMA AMSA JRCC DAFF DCCEEW Department of Defence DPIRD DEMIRS Recfishwest Tuna Australia WAFIC	Activity cessation notification.	Within ten days after cessation of each campaign.	Written	AHO: datacentre@hydro.gov.au AHS: webmaster@hydro.gov.au AFMA:petroleum@afma.gov.au AMSA's JRCC: rccaus@amsa.gov.au DAFF: Petroleum&Fisheries@agriculture.gov.au DCCEEW: Petroleum&Fisheries@agriculture.gov.au DoD: offshore.petroleum@defence.gov.au DPIRD: Environment@dpird.wa.gov.au DEMIRS: petroleum.environment@dmirs.wa.gov.au RecFishWest: info@recfishwest.org.au Tuna Australia WAFIC: oilandgas@wafic.org.au
OPGGS(E) Regulation 54 – Notifications NOPSEMA must be notified that the activity is completed.	NOPSEMA must be notified that the activity is complete.	Within ten days after cessation of each activity campaign.	Written	NOPSEMA

Initiation	Required Information	Timing	Type	Recipient
26C and P(SL)(E) Regulation 16 and 34 DEMIRS must be notified of the environmental performance of the activity.	Report must contain sufficient information to determine whether or not environmental performance outcomes and standards in the EP have been met. Volumes and details of all emissions and discharges to any land, air, marine, seabed, sub-seabed, groundwater, sub-surface or inland waters environment. The environmental performance reports should include information outlining the scope, a summary of works and operations, environmental performance, review of audits, review of incidents, a review of emissions and discharges, a review of chemicals and other substances, monitoring and research, decommissioning and rehabilitation, a review of the environment plan, awareness, training and exercises, and a summary of the consultation involved.	A detailed environmental performance report for a 12-month period commencing the date of EP acceptance, shall be submitted to DEMIRS within 3 months post reporting timeframe, on annual basis.	Written	DEMIRS

8.13 Compliance reporting

A detailed environmental performance report will be submitted within three months of submission of end-of-activity notification to DEMIRS.

These compliance reporting requirements are summarised in Table 8-4

8.14 Monitoring and recording emissions and discharges

P(SL)(E)R 2012 Requirements
Regulation 15(7)
The implementation strategy must provide for: a) specified emissions and discharges (whether occurring during normal operations or otherwise) to any air, marine, seabed and sub-seabed environment to be monitored and recorded in a way that: i is accurate; and ii can be audited against the environmental performance standards and measurement criteria in the environment plan; and b) the monitoring mentioned in paragraph (a) to be done either continuously or at specified intervals; and c) tests to assess the performance of the monitoring equipment used for the purposes of paragraph (a) to be conducted at specified intervals.

Vessel-based discharges to the marine environment associated with this activity will be recorded and controlled in accordance with requirements under relevant marine orders.

In addition to the reporting requirements of Table 8-4, Regulation 34 of the *Petroleum (Submerged Lands) (Environment) Regulations 2012* has specific monitoring and reporting requirements to DEMIRS which will include those outlined in Table 8-5.

Discharges associated with this activity will be recorded and controlled in accordance with requirements under AMSA 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 a period of five years. Contractors are required to make these records available upon request.

Any non-compliance with requirements will be included in monthly recordable incident report to DEMIRS.

Table 8-5: Monitoring methods for emissions and discharges

Discharge/emission	Parameter	Record	Recording frequency
Atmospheric emissions	N_2O, NO_x, SO_{2x}, CO_2, ODS	Based on NPI calculations	Annually
Chemicals (discharged to marine environment as per Sections 6.7 and 6.8	Volume	Chemical Risk Assessment. Volumes used will be estimated based on known inventories	For every chemical use with a fate to the marine environment
Oily water	Volume and location (support vessels)	Oil Record Book or equivalent report	For every discharge
Garbage (including food scraps)	Volume and location (support vessel)	Garbage Record Book	For every discharge
Sewage	Volume and location (support vessel)	Sewage Record Book	For every discharge
Unplanned release of solids	Volume	Incident report	For every release
Unplanned discharge of liquid hazardous materials	Volume	Incident report	For every unplanned discharge
Unplanned hydrocarbon release	Volume	Incident report	For every unplanned discharge

8.15 Reviews, audits and inspections

P(SL)(E)R 2012 Requirements
Regulation 15(6)
The implementation strategy must provide for the monitoring of, audit of, management of non-compliance with, and review of, the operator's environmental performance and the implementation strategy.

This part of the implementation strategy provides for monitoring, recording, audit, management of non-conformance and review of environmental performance including demonstration that the environmental performance objectives and standards are being met.

8.15.1 Reviews

This EP includes an assessment of impacts and risks across the entire operational area, during any time of the year for planned and unplanned events given the nature of the 24/7 operations.

It is recognised that the following may change over the term of the EP:

- Legislation
- Regulator policy and guidance
- Businesses conditions, activities, systems, processes and people
- Industry practices
- Science and technology
- Societal and stakeholder expectations
- Petroleum industry survey, exploration and development activities
- Knowledge about control measure effectiveness and environmental impacts and risks
- Financial assurance requirements

Through maintenance of up-to-date knowledge, these changes are identified. If the changes have an impact on the activity or risks described and assessed in this EP, the EP will be reviewed and any changes required documented in accordance with Santos' MoC procedure (Figure 8-1).

8.15.2 Maintaining up-to-date knowledge

To ensure Santos maintains up to date knowledge of the industry, legislation and conservation advice, the following tasks are undertaken:

- Maintaining membership of APPEA, which provides a mechanism for communicating to relevant personnel in Santos potential changes in legislation, industry practice and other issues that may affect EP implementation
- Undertaking annual spill response exercises to check spill response arrangements and capability are adequate
- Identifying stakeholders prior to any activity commencing under this EP via the mechanisms outlined in Section 4
- Reviewing the values and sensitivities within the EMBA, which includes completing a new EPBC Protected Matters Search and reviewing any recently known published relevant scientific papers as required
- Reviewing Appendix B against relevant legislation to capture and review any relevant updates and incorporate as required
- Subscribing to various regulator updates
- Regular liaison meetings with regulators.

Through maintenance of up-to-date knowledge, these changes are identified. If the changes have an impact on the activity or risks described and assessed in this EP, the EP will be reviewed and any changes required documented in accordance with Santos' MoC procedure (Figure 8-1).

8.15.3 Audits

Santos audit plans and schedules are reviewed and updated at the beginning of each calendar year and cover all Santos facilities and activities. Santos' audit schedule may be amended to accommodate operational priorities,

activity risk, personnel availability or high audit demand during certain periods (e.g. regulatory audits, contractor audits).

Audits will be undertaken to inform compliance reporting associated with this EP in a manner consistent with Santos' Assurance Standard (QE-91-ZF-100073). The frequency of these audits may change due to operational requirements but will be undertaken at least once per year.

Audit scope typically includes a selection of control measures and environmental performance standards and outcomes. However, audits may also include other parts of the EP.

Audits findings may include opportunities for improvement and non-conformances. Audit non-conformances are managed as described in Section 8.15.5.

8.15.4 Inspections

During an activity, frequent HSE inspections will be conducted to identify hazards, incidents and EP non-conformances to check compliance against all the environmental performance objectives and standards of this EP (Table 8-2) Any in-field opportunities for improvement or corrective actions will be discussed during the inspection with the work area supervisor and/or crew. Inspection reports will be distributed for review to Santos relevant personnel (e.g. Operations Superintendent, Santos onboard representatives), and HSE Department representatives.

8.15.5 Non-conformance management

EP non-conformances will be addressed and resolved by a systematic corrective action process as outlined in Santos' Assurance Standard (QE-91-ZF-10007). Non-conformances arising from audits and inspections will be entered into Santos' incident and action tracking management system (i.e. 'Enablon'). Once entered, corrective actions, time frames and responsible persons will be assigned. Corrective action 'close out' will be monitored using a management escalation process.

8.16 Continuous improvement

For this EP, continuous improvement will be driven by the list below and may result in a review of the EP, with changes applied in accordance with Section 8.9:

- 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 concerns and issues raised during the ongoing stakeholder consultation process (Section 4)
- Identified continuous improvement opportunities will be assessed in accordance with the MoC process (Section 8.9) to ensure any potential changes to this EP or the OPEP are managed in accordance with the *P(SL)(E)R 2012* and in a controlled manner.

8.17 Post Acceptance consultation implementation strategy

8.17.1 Post-acceptance consultation implementation strategy – First Nations people and groups, local governments, communities and industry

Santos is committed to appropriate post acceptance consultation implementation for this Activity with relevant government authorities and other relevant interested persons and organisations.

Post acceptance consultation activities for this EP will be principally supported by Santos' regional engagement program for its existing operational footprint in the Carnarvon Basin, with a focus on First Nations people and groups and local governments, communities, and industry with interests in the lands and waters of the adjacent Pilbara region.

8.17.2 First Nations people and groups

Santos will undertake consultation over the life of the activity with First Nations representative organisations, such as Prescribed Body Corporates (PBCs) and Native Title Representative Bodies.

These engagements will be undertaken principally through Santos' existing regional engagement program, which has a focus on engaging those organisations with closest proximity to Santos' existing, proposed and planned activities in the Carnarvon Basin.

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.

- Santos is currently in discussion with four Pilbara PBCs on the establishment of consultation frameworks that will provide for effective and regular engagement on proposed, planned, existing and completed activities. Wirrawandi Aboriginal Corporation
- Ngarluma Aboriginal Corporation
- Murujuga Aboriginal Corporation
- Yamatji Marlpa Aboriginal Council

Engagement of all First Nations organisations will include consideration of culturally appropriate management measures for inclusion within EPs, where First Nations people believe that there may be impacts or risks, or have concerns with regards to:

- Traditional lands and waters
- Sea country interests
- Totemic species

8.17.3 Local government, communities, and industry

Similarly, Santos will use its existing regional engagement program, to support consultation over the life of the activity in regional communities proximate to Santos' existing, proposed and planned activities. Representative groups identified by Santos for engagement include:

- Local government –Shire of Ashburton City of Karratha and Port of Dampier
- Local industry –Onslow Chamber of Commerce and Industry and Karratha and Districts Chamber of Commerce and Industry

This regional approach is complementary to Santos existing and ongoing engagement of representative groups for other offshore marine user groups, including commercial fishing organisations.

8.17.4 Post-acceptance consultation implementation strategy – approach

Activity notifications and reports will be made in accordance with Table 8-4. The notifications and reports are based on legislative requirements, standing arrangements with particular Relevant Persons, Relevant Persons' requests for notification made during Regulation 25 consultation, or as otherwise deemed appropriate by Santos.

Following Activity commencement, Santos will also provide quarterly updates on the Activity to registered / subscribed interested parties.

Santos will apply the regional engagement model described in Section 8.17.3 to consider the preference of with relevant government authorities and other relevant interested persons and organisations when determining the frequency and method of additional updates.

Santos will continue to apply, 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 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 Management of Change process outlined in Section 8.9.

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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Appendix A Santos EHS Policy

Environment, Health & Safety

SMS 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 Relevant legislation, standards and codes of practice

Commonwealth legislation

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
Aboriginal and Torres Strait Islander Heritage Protection Act 1984	This Act provides for the preservation and protection from injury or desecration areas and objects that are of significance to Aboriginal people, under which 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	Commonwealth – Department of Environment and Energy	No known sites of Aboriginal Heritage Significance within the operational area or EMBA.	N/a
Australian Ballast Water Requirements, Version 8 (2020)	Australian Ballast Water Management Requirements outline the mandatory ballast water management requirements to reduce the risk of introducing harmful aquatic organisms into Australia's marine environment through ballast water from international vessels. These requirements are enforceable under the Biosecurity Act 2015.	Yes	Commonwealth – Department of Agriculture and Water Resources	Potential internationally sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange	Section 7.1 – Introduction of IMS
Australian Heritage Council Act 2003	This Act identifies areas of heritage value listed on the Register of the National Estate and sets up the Australian Heritage Council and its functions.	Yes	Australian Heritage Council	There are no national heritage places found on the National Heritage List, within the operational area. The Dampier Archipelago t national heritage places are within the EMBA.	Section 3.2.4 – Protected/significant areas
*Australian Maritime Safety Authority Act 1990 (*AMSA Act)	This Act specifies that AMSA's role includes protection of the marine environment from pollution from ships and other environmental damage caused by shipping. AMSA is responsible for administering the Marine Orders in Commonwealth waters. AMSA is the spill control agency for shipping sourced spill in Commonwealth waters. Facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to	Yes	Commonwealth – Department of Infrastructure, Regional Development and Cities	Vessel movements. Marine Orders administration. Spill control agency (in Commonwealth waters).	Section 7.8 – Vessel to vessel collision rupturing a fuel tank

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
	deal with oil pollution emergencies. Requirements are given effect through 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.				
Climate Change Act 2022	The Climate Act commenced in September 2022. The Act sets out Australia's net-zero commitments and codifies Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement.	Yes	Commonwealth- Department of Climate Change, Energy, the Environment and Water	Vessel movements, discharges and emissions	Section 6.4
Marine Orders	Marine orders are subordinate rules made pursuant to the *Navigation Act 2012* and *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* 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	AMSA	Vessel movements, safety, discharges and emissions	Section 6and 7
Aquatic Resources Management Act 2016	This Act will be the primary legislation used to manage fishing, aquaculture, pearling and aquatic resources in Western Australia. The Act was scheduled for commencement on 1 January 2019, however, this has been deferred while an amendment to the Act is progressed.	Yes	Department of Primary Industries and Regional Development	Vessel movements have the potential to introduce IMS	Section 7.1 – Introduction of IMS
Maritime Powers Act 2013	Protects the heritage values of shipwrecks and relics for shipwrecks over 75 years. It is an offence to interfere with a shipwreck covered by this Act. Available historic shipwreck locations covered by international conventions enacted by this legislation have been identified and assessed (as applicable) within this EP.	Yes	The Department of Immigration and Border Protection	No planned interaction or interference. Potential impact could be due to a hydrocarbon spill.	Section 7.6 – 7.8 Accidental Release of hydrocarbons
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act provides the Commonwealth with powers to take measures of quarantine, and implement related programs as are necessary, to prevent the introduction of any plant, animal, organism or matter that could contain anything that could threaten Australia's native flora and fauna or natural environment. The Commonwealth's	Yes	Commonwealth – Department of Agriculture, Fisheries and Forestry	Potential internationally-sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange.	Section 7.1 – Introduction of IMS

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
	powers include powers of entry, seizure, detention and disposal. 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.				
Environment Protection and Biodiversity Conservation Act 1999 Environment Protection and Biodiversity Conservation Amendment Regulations 2006	The Act aims to: • Protect MNES • Provide for Commonwealth environmental assessment and approval processes • Provide an integrated system for biodiversity conservation and management of protected areas.	Yes	Commonwealth – Department of Climate Change, Energy, the Environment and Water	The activity involves potential impacts to MNES which are threatened and migratory species;	Sections 6and 7 (planned and unplanned events)
Underwater Cultural Heritage Act 2018 *Underwater Cultural Heritage (Consequential and Transitional Provisions) Act 2018*	This Act replaces the *Historic Shipwrecks Act 1976* and extends protection to other wrecks such as submerged aircraft and human remains. It also increases penalties applicable to damaged sites. The Act came into effect on 1 July 2019.	Yes	Commonwealth – Department of Climate Change, Energy, the Environment and Water	No planned interaction or interference to shipwrecks. Potential impact could be due to a hydrocarbon spill.	Section 7.6 – 7.8 – Unplanned hydrocarbon spills
National Greenhouse and Energy Reporting Act 2007	Introduces a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects and energy use and production of corporations.	Yes	Commonwealth – Department of Climate Change, Energy, the Environment and Water; and Climate Change Authority	Atmospheric emissions through combustion engine use to operate the vessels. To reduce impact of GHG emissions, Santos will comply with MARPOL Annex VI (Marine Order 97: Marine Pollution Prevention – Air Pollution) and require the use of low sulphur fuel.	Section 6.4 – Atmospheric emissions
Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007	This Act implements the requirements of MARPOL 73/78 Annex VI for shipping in Commonwealth waters.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Atmospheric emissions through combustion engine use to operate the vessels. To reduce impact of GHG emissions, Santos will comply with MARPOL Annex VI (Marine Order 97: Marine Pollution Prevention – Air	Section 6.4 – Atmospheric emissions

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
				Pollution) and require the use of low sulphur fuel.	
Navigation Act 2012	An act regulating navigation and shipping including Safety of Life at Sea (SOLAS). A number of Marine Orders enacted under this Act apply directly to offshore petroleum exploration and production activities: • Marine Order 17: Liquefied Gas Carriers and Chemical Tankers • Marine Order 21: Safety and Emergency Arrangements • Marine Order 30: Prevention of Collisions • Marine Order 47: Mobile Offshore Drilling Units • Marine Order 50: Special Purpose Ships • Marine Order 57: Helicopter Operations • Marine Order 59: Off-shore Industry Vessel Operations • Marine Order 60: Floating Offshore Facilities.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Vessel movements, marine safety and shipping movements.	Section 6.6 – Interaction with other marine users
Offshore Petroleum and Greenhouse Gas Storage Act 2006 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023	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". The current OPGGS (E) Regulations 2009 have been remade into the 2023 Environment Regulations in essentially the same form with no substantive changes to policy. The revisions are limited to minor amendments to provide consistency with current drafting practices, simplify language, and restructuring and renumbering of regulatory provisions for ease of navigation.	No	NOPSEMA	N/a	N/a
Ozone Protection and Synthetic Greenhouse Gas Management Reform	Regulates the manufacture, importation and use of ozone depleting substances (typically used in fire-fighting equipment and refrigerants). Applicable to the handling of any ODS.	Yes	Commonwealth – Department of Climate Change, Energy, the Environment and Water	No import, export or manufacture activities of ODS. ODSs are being phased out and are rarely found on a vessel's or	Section 6.4 – Atmospheric emissions

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
(closing the Hole in the Ozone Layer) Act 2022				mobile offshore drilling unit's refrigeration system.	
Protection of the Sea (Powers of Intervention) Act 1981 Protection of the Sea (Powers of Intervention) Regulations 1983	The Act authorises the Commonwealth 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.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Potential impacts to Commonwealth waters in the event of a hydrocarbon spill.	Section 7.6 – 7.8 Unplanned hydrocarbon spills
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	This Act relates 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 a shipboard waste management plan. 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 – Harmful Substances in Packaged Forms • Marine Order 95: Marine Pollution Prevention – Garbage • Marine Order 96: Marine Pollution Prevention – Sewage • Marine Order 97: Marine Pollution Prevention – Air Pollution • Marine Order 98: Marine Pollution – Anti-fouling Systems.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Only relevant to the extent that Santos will comply with MARPOL through the following relevant 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	Section 6.6 – Operational discharges Section 7.6 – 7.8 Unplanned hydrocarbon spills
Protection of the Sea (Civil Liability of Bunker Oil Pollution Damage) Act 2008	This Act implements the requirements for the International Convention on Civil Liability for Bunker Oil Pollution Damage.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Refuelling may be undertaken at sea.	Section 7.4 –Hazardous liquid releases

Commonwealth Legislation	Summary	Relevant to Activity?	Administering Authority	Relevant Aspects of the Activity	EP Section
Protection of the Sea (Harmful Antifouling Systems) Act 2006	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 anti-fouling paints used on ships.	Yes	Commonwealth, Department of Infrastructure, Regional Development and Cities	Vessel movements in Australian Waters. Vessels are required to have biofouling systems in place to prevent introduction of invasive marine species/harmful impact on Australian biodiversity.	Section 7.1 – Introduction of IMS

State legislation

State Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
Environmental Protection Act 1986 Environmental Protection Regulations 1987	The *Environment Protection Act 1986* (EP Act) requires all petroleum activities with the potential to cause significant environment harm to be referred to OEPA. The project was referred to the OEPA and approved on 9 July 2009 (Ministerial Statement No. 795). The conditions associated with this ministerial statement, are not relevant to the EP.	No	Office of the Environment Protection Agency	N/A	N/a
Biodiversity Conservation Act 2016	The *Biodiversity Conservation Act 2016* provides for not only listing species, but also threatened ecological communities, key threatening processes (such as land degradation), and critical habitats. The act also establishes recovery plans and other features of biodiversity conservation and management.	yes	Department of Biodiversity, Conservation and Attractions	The activity involves potential impacts to MNES which are threatened and migratory species;	Sections 6 and 7 (planned and unplanned events)
Petroleum Pipelines Act 1969 Petroleum Pipelines (Environment) Regulations 2012	The environment plan must include: (a) details of all environmental impacts and environmental risks of the pipeline activity; and (b) an evaluation of those impacts and risks; and (c) a description of the environmental risk assessment process used to evaluate those impacts and risks, including the terms used in that process to categorise the levels of seriousness of those impacts and risks.	Yes	Department of Energy, Mines, Industry Regulation and Safety	Environmental impacts and environmental risks of the pipeline activity due to: • Artificial light • Noise emissions • Atmospheric emissions • Seabed and benthic habitat disturbance • Operational discharges (surface and subsea)	Section 5 – Impact and risk assessment Section 6– Planned events Section 7 – Unplanned events

State Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
				• Introduction of invasive marine species • Marine fauna interaction • Release of solid objects • Hazardous liquid releases • Hydrocarbon releases (surface and subsea) • Spill response operations.	
Petroleum (Submerged Lands) Act 1982 Petroleum (Submerged Lands) (Environment) Regulations 2012	The environment plan must include: (a) details of all environmental impacts and environmental risks of the pipeline activity; and (b) an evaluation of those impacts and risks; and (c) a description of the environmental risk assessment process used to evaluate those impacts and risks, including the terms used in that process to categorise the levels of seriousness of those impacts and risks.	Yes	Department of Mines, Industry Regulation and Safety	Environmental impacts and environmental risks of the pipeline activity due to: • Artificial light • Noise emissions • Atmospheric emissions • Seabed and benthic habitat disturbance • Operational discharges (surface and subsea) • Introduction of invasive marine species • Marine fauna interaction • Release of solid objects • Hazardous liquid releases • Hydrocarbon releases (surface and subsea) • Spill response operations.	Section 5 – Impact and risk assessment Section 6– Planned events Section 7 – Unplanned events
Conservation and Land Management Act 1984	DBCA is responsible for the day to day management of marine parks vested with MPRA and provide administrative support to the MPRA. Marine nature reserves, marine parks and marine management areas are the three reserve categories vested in the MPRA. Offshore operations must comply with specific marine park conditions when navigating or conducting activities in or near areas designated as marine sanctuaries for conservation, recreational, ecological,	Yes	Department of Biodiversity, Conservation and Attractions	Unplanned hydrocarbon/ chemical release.	Sections 7.6 to 7.8 Unplanned hydrocarbon spills

State Legislation	Summary	Relevant to activity?	Administering Authority	Relevant aspects of the activity	EP Section
	historical, research, educational, or aesthetic qualities.				
Environmental Protection (Unauthorised Discharges) Regulations 2004	The purpose of the Regulations is to cover discharges into the environment from business or commercial activity which are not serious enough to cause pollution or environmental harm and breach the provisions of the EP Act.	Yes	Department of Water and Environment Regulation	Unplanned hydrocarbon/ chemical release (Response Actions – OPEP).	Section 7.6 – 7.8 Unplanned hydrocarbon spills
Environment Protection (Controlled Waste) Regulations 2004	Regulates the transportation of controlled waste on roads in Western Australia (e.g. storage, handling, labelling, transport, tracking).	Yes	Department of Water and Environment Regulation	Unplanned hydrocarbon/ chemical release (Response Actions – OPEP).	Section 7.6 – 7.8 Unplanned hydrocarbon spills
Fish Resources Management Act 1994 Fish Resources Management Regulations 1995	This Act establishes a framework for management of fishery resources and is the nominated lead agency responsible for implementing Western Australian marine biosecurity management requirements through implementation of the *Fish Resources Management Act 1994* (FRMA 1994) and associated regulations.	Yes	Department of Primary Industries and Regional Development	Introduction of IMS.	Section 7.1 – Introduction of IMS
West Australian Maritime Archaeology Act 1973	Protects maritime archaeological sites on state land and in State waters, such as bays, harbours and rivers. Other than shipwrecks, it includes single relics, such as an anchor, and land sites associated with exploration, early settlements, whaling and pearling camps and shipwreck survivor camps.	No	Western Australian Museum	No archaeological relics identified within operational area or EMBA.	N/A

International agreements and conventions

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972	Implemented in WA *Marine (Sea Dumping) Act* and *Environmental Protection (Sea Dumping) Act 1981*.	Yes	• Sewage, greywater, and putrescible wastes generated from support vessels • Deck drainage/deck washdown, cooling, brine, ballast and bilge water from support vessels • Hydraulic fluid released by valve operation on subsea infrastructure	Section 6.6 – Operational discharges

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
			• Various discharges from planned maintenance activities.	
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 (commonly referred to as the Japan-Australia Migratory Bird Agreement)	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 EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	Sections 7.6 to 7.8 Unplanned hydrocarbon spills
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 (commonly referred to as the China-Australia Migratory Bird Agreement)	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 EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	Sections 7.6 to 7.8 Unplanned hydrocarbon spills
Convention for the Control of Transboundary Movements of Hazardous Wastes and Their Disposal 1989 (Basel Convention)	This convention deals with the transboundary movement of hazardous wastes, particularly by sea. Implemented in *Hazardous Waste (Regulation of Exports and Imports) Act 1989.*	No	Activity does not involve transboundary movement of hazardous wastes.	N/A
United Nations Convention on Biological Diversity 1992	An international treaty to sustain life on earth.	Yes	Relevant only insofar as the activity may interact with MNES (threatened and migratory species) protected under the EPBC Act.	Sections 6 and 7 (planned and unplanned events)
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.	Yes	In the event that worst-case credible spill scenarios may enact a national arrangement for response.	Sections 7.6 to 7.8 Unplanned hydrocarbon spills Section 6.8 – Hydrocarbon spill response
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.	Sections 7.6 to 7.8 Unplanned hydrocarbon spills Section 6.8 – Hydrocarbon spill response
International Convention for the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund 92)	This convention ensures compensation is provided for damage caused by oil pollution.	No	Relevant to oil tankers, not supply or support vessels.	N/A

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
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 five Annexes, dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage and garbage. 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*, the *Navigation Act 1912* and several Parts of Marine Orders made under this legislation.	Yes	Already dealt with through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* – refer to legislation table above.	N/A
International Convention for the Safety of Life at Sea 1974	This convention is generally regarded as the most important of all international treaties concerning the safety of merchant ships Implemented in the *Air Navigation Act 1920.*	Yes	Only relevant in so far as SOLAS relates to safety aspects of the activity, such as navigation aids which reduce potential for vessel collision and hydrocarbon release to the environment.	Section 6.6 – Interaction with other users
International Convention on Civil Liability for Oil Pollution Damage (1969)	This convention provides a mechanism for ensuring the payment of compensation for oil pollution damage.	No	Relevant to oil tankers.	N/A
International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention) 2004	The International Maritime Organisation has been addressing the problem of IMS in ships' ballast water since the 1980s. Ballast water and sediments guidelines were adopted in 1991 and the ballast water convention was adopted in 2004. Recent accession by Finland has triggered the final entry into force of these international requirements. As a result, the International Convention for the Control and Management of Ships Ballast Water and Sediment will enter into force on 8 September 2017 (Briefing 22 2016). It aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Ballast Water Management systems must be approved by the Administration in accordance with this	Yes	Potential internationally sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange.	Section 7.1 – Introduction of IMS

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	International Maritime Organization Guideline.			
United Nations Convention on the Law of the Sea (1982)	Part XII of the convention sets up a general legal framework for marine environment protection. The convention imposes obligations on State Parties to prevent, reduce and control marine pollution from the various major pollution sources, including pollution from land, from the atmosphere, from vessels and from dumping (Articles 207–212). Subsequent articles provide a regime for the enforcement of national marine pollution laws in the many different situations that can arise. Australia signed the agreement relating to the implementation of Part XI of the Convention in 1982, and United Nations Convention on the Law of the Sea in 1994.	Yes	Only relevant to the extent that Santos will comply with MARPOL through the following relevant 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 95: Marine Pollution Prevention – Garbage • Marine Order 96: Marine Pollution Prevention – Sewage • Marine Order 97: Marine Pollution Prevention – Air Pollution • Marine Order 98: Marine Pollution – Anti-fouling Systems.	Section 6.6 –Operational discharges Sections 7.6 to 7.8 Unplanned hydrocarbon spills
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 December 1993.	Yes	Only relevant in to the extent that to reduce impact of GHG emissions associated with 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.	Section 6.4 – Atmospheric emissions

Standards and codes of practice

Standard/Code of Practice	Summary	Relevant to Activity?	Relevant Aspects	EP Section
AS 2885.1: Pipelines, Gas and Liquid Petroleum -Design and Construction	Australian Standard that the gas pipelines have been designed and constructed in accordance with.	No	This standard applied to construction and design.	NA
AS 2885.3: Pipelines, Gas and Liquid Petroleum – Operation and Maintenance	Australian Standard applying to the operation and maintenance of the gas pipelines.	Yes	Operation of the pipelines including inspection, monitoring, maintenance and repair activities.	Section 6.6 – Operational Discharges

Standard/Code of Practice	Summary	Relevant to Activity?	Relevant Aspects	EP Section
				Section 7.6 – Accidental Release of Hydrocarbons
AS 2885.4: Offshore Submarine Pipeline Systems	Australian Standard applying to the design, construction, operation and abandonment of the submarine pipeline.	Yes	Operation of the submarine DC supply pipeline, including inspection, monitoring, maintenance and repair activities.	Section 6.6 – Operational Discharges Section 7.6 – Accidental Release of Hydrocarbons Section 7.7 Subsurface Release of Condensate from the DC Pipeline
DNV-OS-F101: Submarine Pipeline Systems	Standard applying to the design, construction, operation and abandonment of the submarine pipeline.	Yes	Operation of the submarine DC supply pipeline, including inspection, monitoring, maintenance and repair activities.	Section 6.6 – Operational Discharges Section 7.6 – Accidental Release of Hydrocarbons Section 7.7 Subsurface Release of Condensate from the DC Pipeline

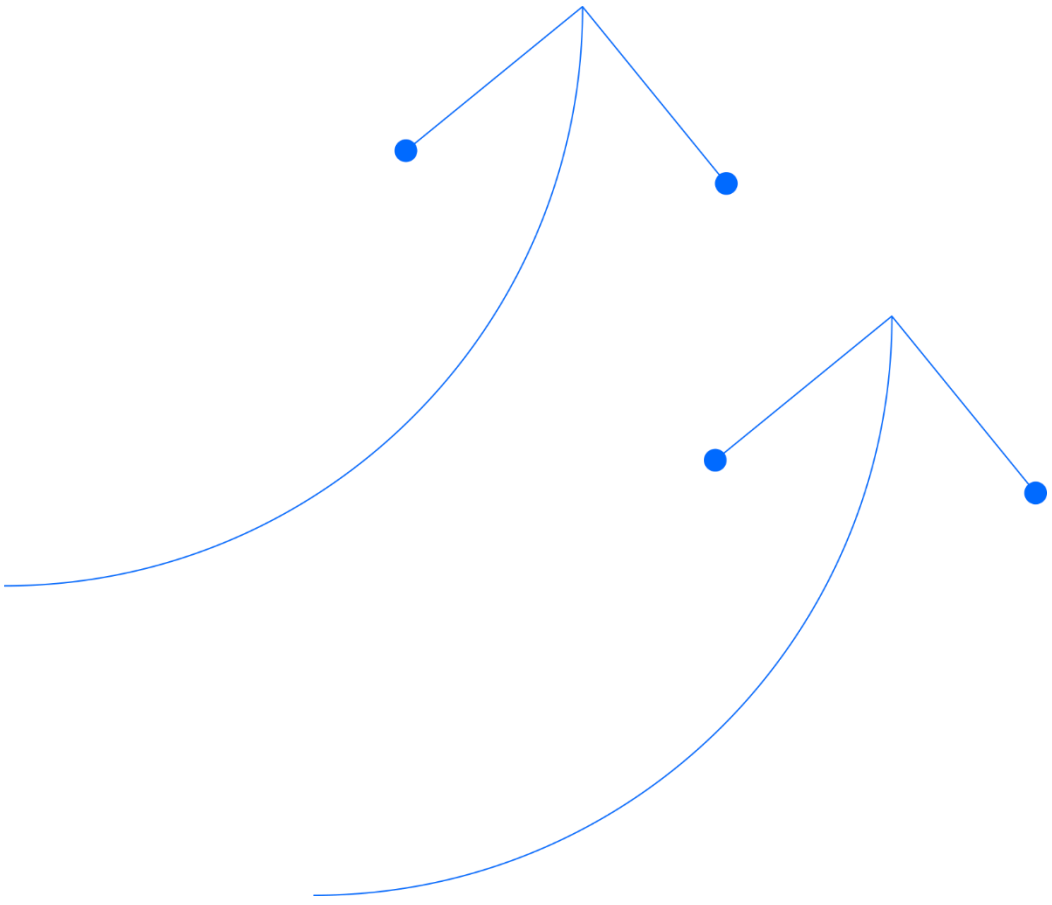
Appendix C Description of the environment

Santos

VALUES AND SENSITIVITIES OF THE MARINE AND COASTAL ENVIRONMENT

24 April 2024

Document No.: 7715-650-REP-0247



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1. Introduction

1.1. Overview

Santos Northwest Pty Ltd (Santos) operates the Devil Creek Gas Plant (DCGP), located approximately 45 km southwest of Karratha, Western Australia (WA) that ties into the offshore Reindeer gas field.

All activities described in DC Gas Supply Pipeline Environment Plan (EP; 7715-650-EMP-0022-01) are associated with the operation and future preservation of the WA State waters (permit TPL20) and onshore (permit PL81) sections of the Devil Creek (DC) gas supply pipeline (DC supply pipeline) and the onshore Devil Creek sales gas export pipeline (DC sales gas pipeline) from the DCGP to the Dampier to Bunbury Natural Gas Pipeline (DBNGP) (permit PL86). These are collectively referred to as the Devil Creek pipelines (DC pipelines). The DC Pipelines are within State waters and onshore WA.

Santos is planning for the preservation of the DC supply pipeline. The DC Gas Supply Pipeline EP covers the operations phase of the DCGP and pipeline, the cessation of production (CoP) phase of the pipeline, and the inspection, maintenance, monitoring and repair (IMMR) which will be undertaken during the operations or CoP phase.

This document supports the DC Gas Supply Pipeline EP and describes the existing environment that may be affected (EMBA) by the activity and includes details of the relevant values and sensitivities of that environment, as required by the State Petroleum (Submerged Lands) (Environment) Regulations (P(SL)(E)R) 2012.

Section 3.1 of the DC Gas Supply Pipeline EP describes the EMBA and how it was determined for the activity. It is important to note that the EMBA is used to identify the full range of environmental and socioeconomic receptors, however, it is not considered representative of potential ecological impacts (NOPSEMA, 2019).

This document is informed by the protected matters report (Appendix D of the DC Gas Supply Pipeline EP), stated values in the Marine Bioregional Plan for the North-West Marine Region (NWMR) (DSEWPaC, 2012a,b), published scientific literature and studies and information obtained through consultation. Marine and coastal species identified in the protected matters report (Appendix D of the DC Gas Supply Pipeline EP) 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 protected matters report incorporates an in-built buffer and hence may report on matters that are actually outside the EMBA.

1.2. Geographical Extent

The DC pipelines are within State waters and onshore WA and comprise:

- The approximately 48 km long State waters section of the DC supply pipeline, from kilometre points (KPs) 0 at the mean low water mark to 48.3 where the DC supply pipeline crosses into State waters;
- The approximately 11 km long onshore section of the DC supply pipeline, buried underground, from KP0 at the mean low water mark to KP11.156 at the DCGP; and
- The approximately 40 m long onshore DC sales gas pipeline, buried underground, from the DCGP to the DBNGP.

The DC supply pipeline feeds into the DCGP, which is located approximately 10 km inland from Gnoorea Point and Forty Mile Beach. The DCGP is adjacent to Forty Mile Beach Road and is in close proximity to the intersection of Forty Mile Beach Road with the North West Coastal Highway. The EMBA is located entirely within Australian coastal waters in northwest Western Australia, and is located entirely within the North-West Marine Region (NWMR). Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0 spatial framework, only the Northwest Shelf Province provincial-scale bioregion that occurs within the EMBA. Bioregions are based on the characteristics of fish assemblages, benthic habitats, and oceanographic data (IMCRA v. 4.0). Where relevant, the physical, biological, and social environments within the EMBA are discussed with reference to the IMCRA Provincial Bioregion.

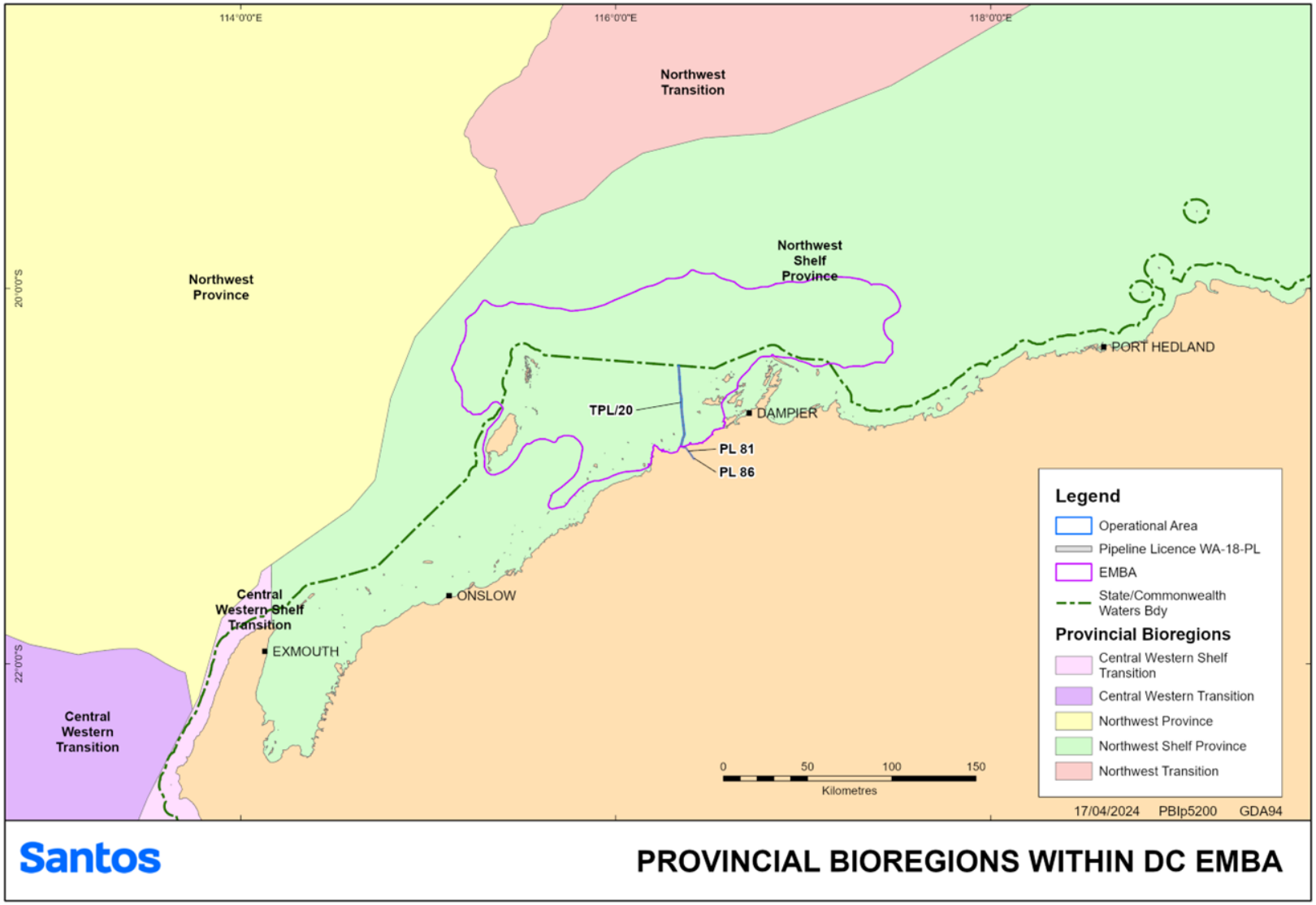


Figure 1: IMCRA 4.0 Provincial Bioregion within the EMBA

2. Physical Environment

2.1. Geomorphology

2.1.1. Formation History

Approximately 550–160 million years ago, the northern and western parts of the present-day Australian continent formed part of the northern margin of Gondwana. About 300 million years ago, crustal stretching, rifting and breakup initiated the development of an extensive basin that became the site for deposition of sediments (Baker et al. 2008 in Department of the Environment, Heritage, Water, and the Arts (DEWHA) 2008a). Approximately 135 million years ago the continent broke up resulting in the separation of greater India and Australia. Ocean spreading associated with the continental break-up resulted in the creation of the Argo and Cuvier abyssal plains. Subsidence of the rifted margin resulted in the formation of the Exmouth and Scott plateaux and the Rowley Terrace. The narrow shelf south of North West Cape was formed approximately 130 million years ago as a result of the separation of India and sea floor spreading (Baker et al. 2008 in DEWHA 2008a).

2.1.2. Present Day Geological Features

The EMBA overlaps one main landform feature (continental shelf) and a small area of continental slope. Limited surveys have shown that the continental slope in the EMBA comprises diverse geological features such as canyons, plateaux, terraces, ridges, reefs, banks and shoals (DEWHA 2008a). These features are significant in that over half of the total area of banks and shoals across Australia's entire marine jurisdiction occurs in the Commonwealth waters from the South Australian border to the Northern Territory border, as well as 39 % of terraces and 56 % of deeps, holes and valleys (DEWHA 2008a).

2.1.3. Northwest Shelf Province

The Northwest Shelf Province is located almost entirely on the continental shelf, except for a small area to the north of Cape Leveque that extends onto the continental slope. This bioregion includes more than 60 % of the continental shelf in the North-west Marine Region (DEWHA, 2008a). The shelf gradually slopes from the coast to the shelf break but displays a number of sea floor features such as banks/shoals and holes/valleys. These are thought to be morphologically distinct from other features of these types found elsewhere in the North-west Marine Region, and have a different sedimentology (DEWHA, 2008a). For example, the Glomar Shoals occur approximately 30–40 km offshore of Dampier in water depths of between 26–70 m and are distinguished by highly fractured molluscan debris, coralline rubble, and coarse carbonate sand. The province also includes the Leveque Rise, a large plateau, and one of only two shelf plateaux within the North-west Marine Region (DEWHA, 2008a).

2.1.4. Sediments

Terrestrial environments are not a major source of sediment to the EMBA and terrigenous sediments tend to be confined to the inner shelf (generally less than 100 m water depth), particularly in areas adjacent to rivers. Sediments in the area generally become finer with increasing water depth, ranging from sand and gravels on the shelf to mud on the slope and abyssal plain.

The distribution and resuspension of sediments on the inner shelf is strongly influenced by the strength of tides across the continental shelf as well as episodic events such as cyclones. Further offshore, on the mid to outer shelf and on the slope itself, sediment movement is primarily influenced by ocean currents and internal tides. Internal tides describe the tidal movement across a slope of water stratified by marked differences in density. Internal tides cause resuspension and net down-slope deposition of sediments on the North West Shelf (DEWHA 2008a).

Surveys conducted over the North West Shelf indicate that similar sediments occur extensively over this geographic region, but with spatial variation in the grain size and origin of the surface sediments.

Shoals and banks are naturally forming, submerged and made of consolidated material such as sand. Normally, the shoal or bank rises close to the water surface having been created when an ocean current deposits sediment. Shoals and banks are found within the EMBA.

2.2. Climate

Waters in northern Western Australia predominantly lie in the arid tropics, experiencing high summer temperatures and periodic tropical cyclones in summer. Rainfall in the region is low, although intense rainfall may occur during the passage of summer tropical cyclones and thunderstorms (Condie et al. 2006). Mean air temperatures range from a minimum of 11°C in winter to a maximum of 36°C in summer (Condie et al. 2006). Due to the arid climate, daytime visibility in the area is generally greater than 5 nautical miles (SSE 1991).

The summer and winter seasons fall into the periods September–March and May–July, respectively. Winters are characterised by clear skies, fine weather, predominantly strong east to southeast winds and infrequent rain (calculated from the National Centres for Environmental Prediction and National Centre for Atmospheric Research (NCEP-NCAR) dataset measured from 1982 to1999; Condie et al. 2006; **Figure 2**).

Summer winds are more variable, with strong south-westerlies dominating. Transitional wind periods, during which either pattern may predominate, can be experienced in April–May and September of each year.

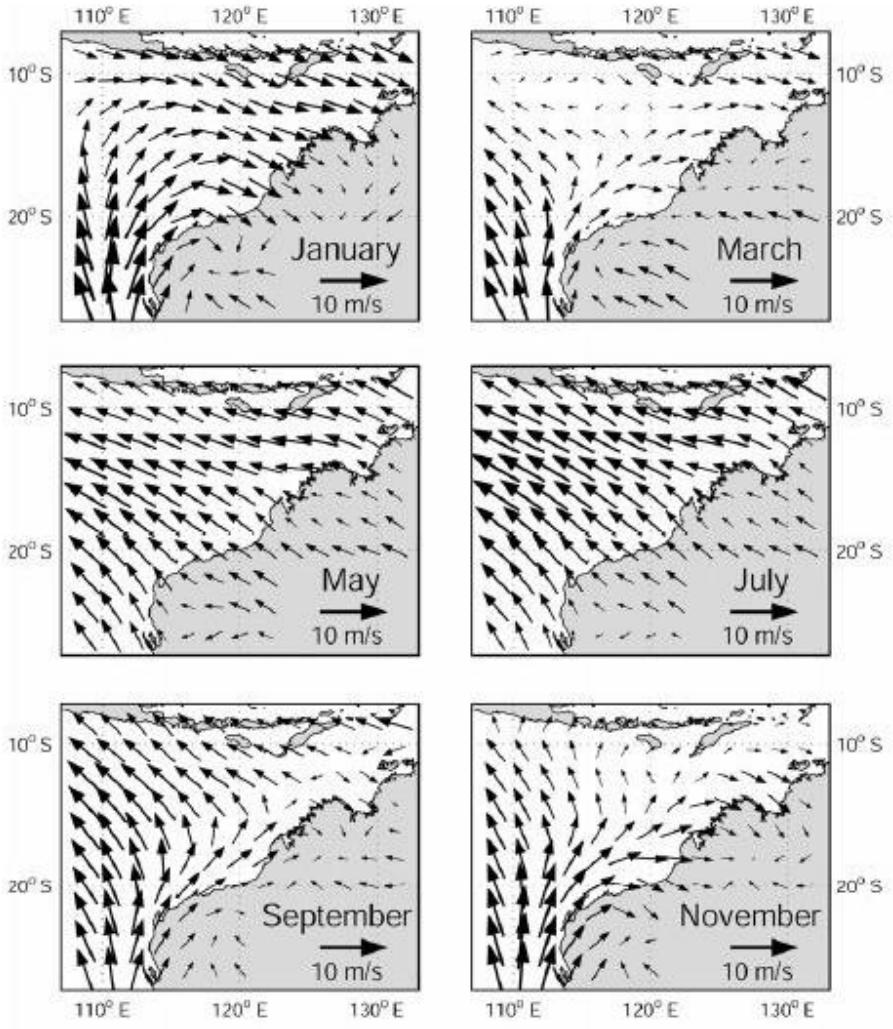


Figure 2: Seasonally averaged winds at 10 m above mean sea level

Calculated from NCEP-NCAR dataset measured from 1982 to 1999. Source: Condie et al. (2006)

Tropical cyclones generate the most significant storm conditions in the area (SSE 1993). These clockwise-spiralling storms have generated wind speeds 50–120 knots (SSE 1991). Tropical cyclones develop in the eastern Indian Ocean, and the Timor and Arafura Seas during the summer months. Three to four cyclones per year are typical, with the official cyclone season being November through to April (Bureau of Meteorology (BoM) 2013).

2.3. Oceanography

Major drivers of marine ecosystems include ocean currents, tides, waves, temperature and salinity. The dominant offshore sea surface current is the Leeuwin Current (**Figure 3**), which carries warm tropical water south along the edge of Western Australia's continental shelf, reaching its peak strength in winter and becoming weaker and more

variable in summer (Condie et al. 2006). The current is typically located seaward of the shelf break (200 m isobath) and is a narrow, surface current, extending to a depth of 150 m (BHPB 2005, Woodside 2005) and a width of 50–100 km (DEWHA 2008a). The strength of the Leeuwin Current is influenced by seasonal variability in the pressure gradient (DEWHA 2008a). The Holloway Current is the prevailing seasonal current, travelling south-west along the north West Australian coast in winter and north-east in summer (Brewer et al. 2007). It is a relatively narrow boundary current that flows along the north-west shelf at between 100 m and 200 m depth, flowing towards the north-east in summer and the south-west in winter (Fugro, 2015).

The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer North West Shelf (Woodside 2005). This current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago (**Figure 3**). Modelling undertaken by Woodside and Commonwealth Scientific and Industrial Research Organisation (CSIRO) Marine and Atmospheric Research indicates that significant east–west flows occur across the North West Shelf to the north of the North West Cape, possibly linking water masses in the area (Woodside 2005, Condie et al. 2006).

Currents in the coastal zone and over the inner to mid-shelf are largely driven by tides and winds, whereas offshore, over the continental shelf, slope and rise are influenced by large scale regional circulation (DEWHA 2008a).

The nearshore Ningaloo Current flows northwards opposite to the Leeuwin Current, along the outside of the Ningaloo Reef and across the inner shelf from September to mid-April (BHPB 2005, Woodside 2005). The nearshore Capes Current, which is to the south of the Ningaloo Current, is a seasonal current that appears strongest between Cape Leeuwin and Cape Naturaliste, in the southwest of Western Australia (Pearce and Pattiaratchi 1999). Strong northwards winds between November and March slow the Leeuwin Current and increase the strength of the Capes Current. Localised upwelling is also known to occur in the area (Pearce and Pattiaratchi 1999).

Tides increase in amplitude from south to north, corresponding with the increasing width of the shelf (Holloway 1983). Tides in the area are generally semi-diurnal (i.e. two high tides and two low tides per day) with a spring/neap cycle.

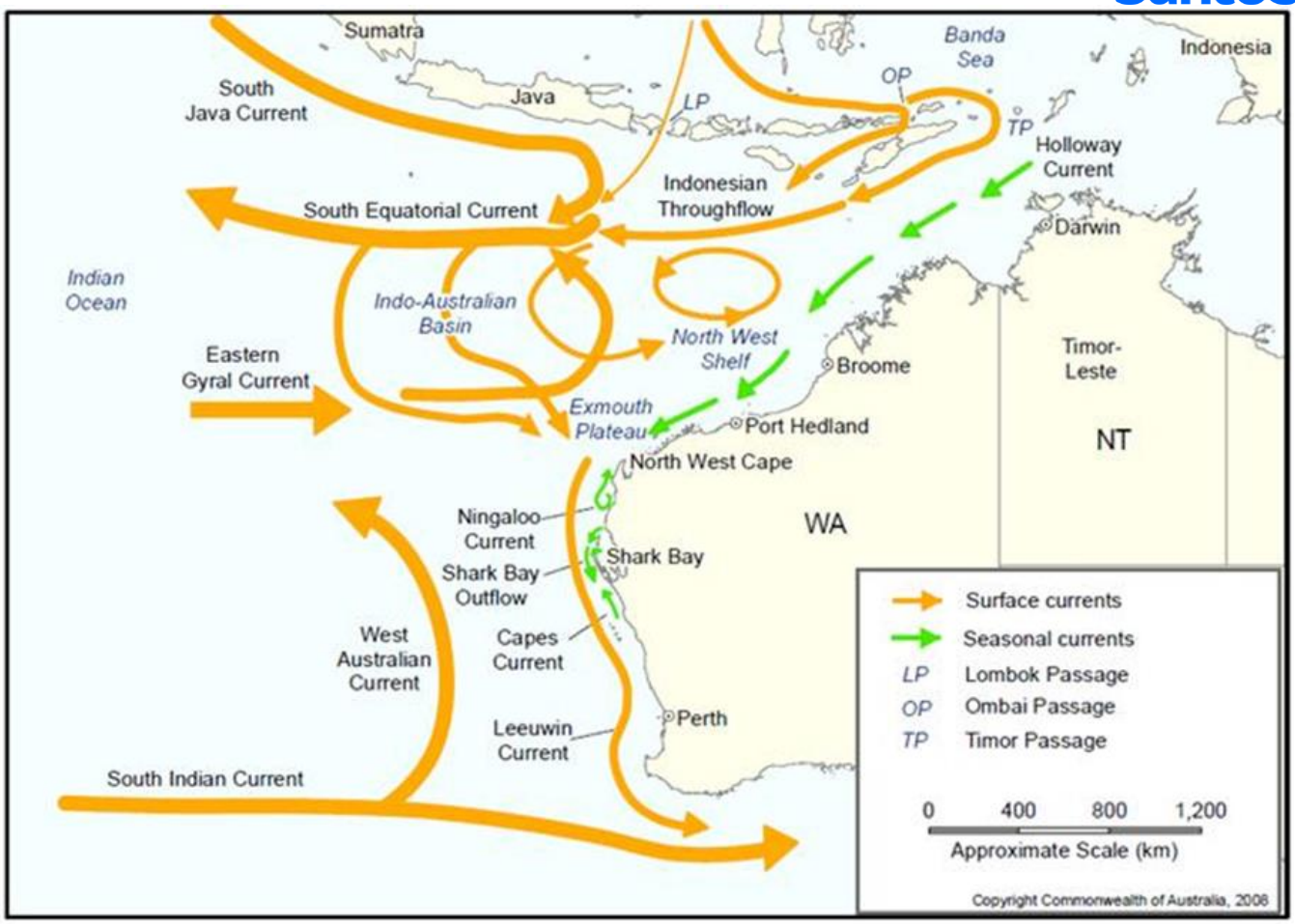
The wave climate in the northwest is composed of locally-generated wind waves (seas) and swells that are propagated from distant areas (WNI 1995). In summer the seas typically approach from the west and southwest, while in winter the seas typically approach from the south and east. Mean sea wave heights are typically less than 1 m and peak heights of less than 2 m are experienced in all months of the year (WNI 1995).

Average swell heights are low, around 0.4–0.6 m in all months. The greatest exposure to swells is from the west (SSE 1993). Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5% (WNI 1996). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed (Holloway & Nye 1985).

Waters on the continental shelf are usually thermally-stratified, with a marked change in water density at approximately 20 m (SSE 1993). Surface temperatures vary annually, being warmest in March (32°C) and coolest in August (19°C). Vertical gradients are related to the seasonality of sea surface temperatures and are greatest during the warm-water season (SSE 1991). Near-bottom water temperature on the North West Shelf is approximately 23°C, with no discernible seasonal variation.

Salinity is relatively uniform at 34–35 ppt throughout the water column and across the North West Shelf. Due to the low rainfall there is little freshwater run-off from the adjacent mainland (Blaber et al. 1985).

Pronounced shifts in water column characteristics can occur following the passage of tropical cyclones (McKinnon et al. 2003). Changes in water temperature and salinity characteristics can result from changes in local heating and evaporation following the southward movement of warmer water due to southward-moving cyclones and can have flow-on effects to primary and secondary productivity (McKinnon et al. 2003).



Source: DEWHA (2008b)

Figure 3: Surface currents in WA

3. Benthic and Pelagic Habitats

Benthic habitats are defined as those subtidal habitats lying below the lowest astronomical tide (LAT).

Benthic habitats are partially driven by light availability. Primary producers (photosynthetic corals, seagrasses and macroalgae) are limited to the photic zone, whereas benthic invertebrates including filter feeding communities may be found in deeper waters. The depth of the photic zone varies spatially and temporally and is predominantly dependent on the volumes of suspended material in the water column. The photic zone in the offshore Pilbara is approximately 70 m whereas in oceanic waters in the northwest and the photic zone may extend to 120 m (DEWHA 2008b).

The following section broadly categorises benthic habitats as four biological communities: coral, seagrasses, macroalgae and non-coral benthic invertebrates. These communities are discussed in terms of the IMCRA v. 4.0 bioregions.

3.1. Coral Reefs

Corals are both primary producers and filter feeders and thus play a role in the provision of food to marine fauna and in nutrient recycling to support ecosystem functioning (Conservation and Land Management (CALM) & Marine Parks and Reserves Authority (MPRA) 2005a).

Corals create settlement substrate and shelter for marine flora and fauna. Studies have shown that declines in the abundance, or even marked changes in species composition of corals, has a marked impact on the biodiversity and productivity of coral reef habitats (Pratchett et al. 2008). As part of the reef building process, Scleractinian corals are also important for protection of coastlines through accumulation and cementation of sediments and dissipation of wave energy (CALM & MPRA 2005a).

Coral reefs in the area fall into two general groups: the fringing reefs around coastal islands and the mainland shore; and large platform reefs, banks and shelf-edge atolls offshore (Woodside 2011). The distribution of corals is governed by the availability of hard substrate for attachment and light availability.

Coral reefs are dynamic environments that regularly undergo cycles of disturbance and recovery. Depending on how frequent and severe the disturbances are, recovery can take a few years or more than a decade. Disturbances can include bleaching, cyclones and disease outbreaks (Australian Institute of Marine Science (AIMS) 2011).

Corals in the northwest and central provinces have experienced bleaching events and subsequent recovery. Bleaching is the process where symbiotic algae are expelled from the coral tissue, often leading to the death of the colony. Causes of bleaching include high temperatures (Ningaloo; 2011 and Scott Reef; 1998 and 2016) (information available at AIMS.gov.au), anoxic conditions (Bill's Bay; 2008) or smothering (Waples & Hollander 2008, Gilmour et al. 2013). Coral susceptibility to bleaching and their ability to recover is an important consideration in the context of potential anthropogenic impacts.

3.1.1. Northwest Shelf Province

This province contains numerous small coastal islands in addition to larger archipelago and offshore island groups. Many of these features are surrounded by shallow waters with small barrier and fringing reefs that support coral communities. Key areas recognised for coral communities in this bioregion are discussed below.

The Dampier Archipelago supports coral reefs in shallow waters near islands and submerged pinnacles. The most significant coral reefs have formed along the seaward slopes of Delambre Island, Hamersley Shoal, Sailfish Reef, Kendrew Island and north-west Enderby Island (CALM & MPRA 2005). Field trips in the Dampier Archipelago between 1972 and 1998 recorded 229 species of corals from 57 genera (Griffith 2004). Surveys of the Dampier Port and inner Mermaid Sound recorded approximately 120 coral species from 43 genera (Blakeway & Radford 2005) with coral reefs dominated by acroporids and pocilloporids. The greatest coral cover (up to 70%) was recorded in the eastern half of the archipelago (Wells et al. 2003).

The Montebello, Lowendal and Barrow islands include 315 islands associated with extensive coral reefs, the most significant of which occur in the sheltered waters on the eastern side of the islands. Examples of these significant reefs include Dugong Reef, Batman Reef and reefs along the Lowendal Shelf (DEC & MPRA 2007a). Dominant corals include acroporids and poritids, with greater than 70% cover recorded for some areas (Chevron 2010). Subtidal coral reef communities around the islands are highly diverse, with at least 150 species of hard corals recorded from fringing and patch coral reef areas (DEC & MPRA 2007a).

Coral distribution near the mainland is restricted by lack of light due to natural turbidity. Corals may exist as sparse coral colonies in some locations, rather than extensive coral communities. Within Exmouth Gulf, coral

communities are less common but are present on fringing reefs surrounding islands, as solitary corals distributed across areas of hard substrate, or on larger isolated patch reefs.

3.2. Seagrasses

Seagrasses are biologically important for four reasons:

- As sources of primary production
- As habitat for juvenile and adult fauna such as invertebrates and fish
- As a food resource
- For their ability to attenuate water movement and trap sediment (Masini et al. 2009).

Twenty-five species of seagrass have been recorded in WA, the highest diversity in the world, and over 30 species of seagrasses have been recorded as occurring within Australian waters (Masini et al. 2009). Waters of the EMBA support predominantly tropical species (Walker 1987). One species, *Cymodocea angustata*, is endemic to WA (Department of Parks and Wildlife (DPAW) 2013).

Areas occupied by seagrass species vary markedly both seasonally and interannually and it is not clear why some areas of suitable substrate will support seagrass in one year but not the next. It appears that recruitment to what may otherwise be suitable substrate is haphazard, lending weight to the descriptions of these seagrass communities as ephemeral (CALM & MPRA 2005, DEC & MPRA 2007a).

3.2.1. Northwest Shelf Province

In the Northwest Shelf Province, seagrasses are present but sparsely distributed to depths of approximately 30 m (LEC & Astron 1993, URS 2009, CALM 2005a). The abundance and distribution of tropical (and subtropical) seagrass species can vary greatly due to seasonal changes in water quality (turbidity, light penetration) and conditions (wave action, temperature), with biomass tending to peak in summer (Lanyon & March 1995).

Studies between Quondong and Coulomb Points north of Broome identified seagrass communities of *Halophila* spp. patchily distributed across large areas, from the lower intertidal and out to a depth of approximately 20 m (DEC 2008, Fry et al. 2008). Similarly, *Halophila decipiens* was the only seagrass collected from epibenthic dredge studies at five localities near Broome from Gourdon Bay to Packer Island (Keesing et al. 2011).

Roebuck Bay is located south of Broome and includes large areas of intertidal mudflats. Extensive seagrass meadows occur in the northern regions of Roebuck Bay and are dominated by *Halophila ovalis* and *Halodule uninervis*. *Halophila minor* and *Halodule pinifolia* have also been reported at this location (Prince 1986, Walker & Prince 1987, Seagrass-Watch 2019).

In the Dampier Archipelago seagrass occurs in the larger bays and sheltered flats of the area (CALM & MPRA 2005). Six species of seagrass, including three Halophila species, have been recorded on the subtidal soft sediment habitats (CALM & MPRA 2005). Seagrasses do not form extensive meadows within the proposed reserves, but rather form interspersed seagrass/macroalgal beds. The largest areas of seagrass are found between Keast and Legendre islands, and between West Intercourse Island and Cape Preston (CALM & MPRA 2005).

In the Montebello/Barrow Islands Marine Conservation Reserves, seagrasses appear not to form extensive meadows but are sparsely interspersed between macroalgae. Seven seagrass species have been recorded in the Reserves (DEC & MPRA 2007a) with *Halophila* spp. the most common seagrass species on shallow soft substrates and sand veneers. Distributions of these species extend from the intertidal zone to approximately 15m water depth (DEC & MPRA 2007a). Surveys to the northwest and southeast of Barrow Island from 2002 to 2004 did not identify any significant seagrass meadows but confirmed the presence of sparse coverage of *Halophila* and *Halodule* spp. in shallow areas east of Barrow Island (RPS BBG 2005).

3.3. Macroalgae

Macroalgae are important contributors to primary production and nutrient cycling in the EMBA, providing food and habitat for vertebrate and invertebrate fauna. Macroalgae are also recognised for their role in spatial subsidies; the movement of nutrients or energy between neighbouring habitats. Spatial subsidies involving macroalgae include the movement of wrack from macroalgal beds to seagrass meadows, bare substrates and shorelines (Orr 2004, Mellbrand et al. 2011).

Macroalgae are primarily associated with hard substrates. They occur in moderate to high cover on exposed hard substrates, but typically have lower cover on hard substrates that are covered with a veneer of sediment (SKM

2009, BHPBIO 2011). Macroalgae exhibit very high seasonal and interannual variation in biomass (Heyward et al. 2006) and distribution, abundance, and biodiversity (Rio Tinto 2009, BHPBIO 2011). The distribution of hard substrates therefore indicates areas that may support macroalgal communities, although abundance and diversity may fluctuate annually.

Macroalgae are susceptible to disturbance from factors such as sedimentation, scouring and turbidity but the marked seasonality in biomass, abundance, diversity, and distribution suggests macroalgae are likely to be resilient to acute, short-term disturbance acting at local scales. Macroalgae may be more susceptible to impacts acting over longer time scales (years) and at certain times of the year, where recruitment at a regional scale could be affected. Indirect impacts affecting the numbers, distribution and community structure of herbivorous fish can also be expected to have impacts (either positive or negative) on macroalgal habitats (Vergès et al. 2011).

3.3.1. Northwest Shelf Province

Macroalgae are diverse and widespread throughout the Northwest Shelf Province. They are restricted to depths where sufficient light penetrates to the substrate and therefore tend to be most common in shallow subtidal waters down to approximately 20 m depth.

In the nearshore regions of the Pilbara, macroalgae are often a dominant component of the mosaic of benthic organisms found on hard substrates in shallow water. In these shallow waters, regular disturbance to reef habitats from seasonal changes in sedimentation/ erosion patterns and the less frequent impacts of cyclones and storms through sedimentation and scouring may substantially alter the distribution and composition of the benthic communities associated with reefs, including macroalgal habitats (BHPBIO 2011).

Macroalgae dominate shallow (<10 m) submerged limestone reefs and also grow on stable rubble and boulder surfaces in the Dampier Archipelago (CALM & MPRA 2005). Huisman and Borowitzka (2003) reported approximately 200 species of macroalgae from the Dampier Archipelago. Low relief limestone reefs that are dominated by macroalgae, account for 17 % (approximately 35,460 ha) of the marine habitats within the proposed Marine Management Area (CALM & MPRA 2005).

Epibenthic dredge surveys along the coastline north of Broome identified 43 species of algae from 22 families (Keesing et al. 2011). The lower species diversity collected by this study is attributed to the method of collection and limited depth range (11–23 m) (Keesing et al. 2011).

Macroalgae occur around the numerous small offshore islands within this bioregion (including Thevenard Island, Airlie Island and Serrurier Island) associated with limestone pavement and protected areas of soft sediments. Dominant species are consistent with those described for the Dampier Archipelago (Woodside 2011).

In the shallow offshore waters of the Pilbara region, macroalgae are the dominant benthic habitat on hard substrates in both the Montebello and Barrow Islands Marine Parks and are the main primary producers (DEC & MPRA 2007a, Chevron 2010). Shallow water habitats outside these marine parks are also likely to support substantial areas of macroalgal habitat wherever conditions are suitable.

Macroalgae occupy approximately 40% of the benthic habitat area in the Montebello/ Lowendal/ Barrow Island region (CALM & MPRA 2005). At least 132 macroalgal taxa occur around Barrow Island, with most thought to be widely distributed in the tropical Indo-Pacific region (Chevron 2005).

Macroalgae monitoring around the Lowendal and Montebello Islands since 1996 (The Ecology Lab 1997, IRCE 2002 2003 2004 2006 2007, URS 2009) has found macroalgal cover and biomass to be naturally spatially and temporally variable. *Sargassum* spp. represented 70% of the macroalgal assemblage in 2009, compared to 96% in 2002 (URS 2009). Sargassum spp. cover as a percentage of total macroalgae cover was significantly lower in 2009 than in previous years, primarily due to an increase in filamentous algae at a number of sites (URS 2009).

3.4. Non-Coral Benthic Invertebrates

The offshore marine environment in the EMBA is overwhelmingly dominated by soft sediment seabeds; sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand veneers, and rarely, exposed hard substrate. In shallow waters, non-coral benthic invertebrates may form part of the mosaic of benthic organisms found on hard substrates, alongside macrophytes and coral colonies. As light reduces with water depth, non-coral benthic invertebrates are the dominant community, albeit at low densities.

Non coral benthic invertebrates feed by filtering small particles from the seawater, typically by passing the water over a specialised filtering structure. Examples of filter feeders are sponges, soft and whip corals and sea squirts.

3.4.1. Northwest Shelf Province

This bioregion is located primarily on the continental shelf in water depths from 0 to 200 m (DEWHA 2008a). The sandy substrates on the shelf within this bioregion are thought to support low density benthic communities of

bryozoans, molluscs and echinoids (DEWHA 2008a). Sponge communities are also sparsely distributed on the shelf but are found only in areas of hard substrate. The region between Dampier and Port Hedland has been described as a hotspot for sponge biodiversity (Hooper & Ekins 2004).

In 2007, CSIRO conducted extensive benthic habitat mapping surveys and epibenthic fauna (living on the surface and ≥1 cm body size) sampling in deep waters (100–1,000 m) spanning thirteen sites between Barrow Island and Ashmore Reef running along the continental shelf and across the continental slope of the North West Shelf (Williams et al. 2010). At the continental shelf margin (approximately 100 m water depth) Williams et al. (2010) reported that similar benthic habitats occurred at each survey site across the breadth of the North West Shelf. Benthic habitats at this depth comprised a mix of riffled muddy sand (sometimes as a veneer over rocky sub-crops) together with gravel to pebble-sized rubble, cobbles, boulders and some rock outcrops. Typical epifauna found at these depths included scattered isolated hydroids, sea fans and soft corals and often small sponges. Other fauna observed at some of the sites included scattered isolated sea whips, crinoids, sea pens, urchins and anemones. Epibenthic fauna along the continental shelf margin were quantified as sparse and low diversity (Williams et al. 2010). Modelling indicated that a trawl sample of 1 km length would generally be expected to yield approximately 80 individuals represented by 15 species (Williams et al. 2010) in 100 m depth waters.

At the shelf edge (approximately 200 m water depth), two sites were surveyed. Both sites were similar to the continental shelf margin, except the northern site mainly comprised coarse material. Epifauna observed at the northern site was similar at 200 m as at 100 m. At the southern site, epifauna included sparse and scattered individual soft corals, anemones, glass sponges and stalked crinoids (Williams et al. 2010). Modelling indicated epibenthic fauna were sparse and had low diversity, numbering approximately 20–40 individuals in a 1 km long trawl sample represented by approximately 5–10 species (Williams et al. 2010).

Baseline studies undertaken in nearshore areas of the Pilbara (SKM 2009, Rio Tinto 2009, BHPBIO 2011) and offshore areas around Barrow Island (Chevron 2010) have shown that filter feeder communities are a dominant component of benthic habitats in depths >10 m where reduced light appears to inhibit extensive development of hard corals and macroalgae. The pavement habitats between Barrow Island and the mainland are covered by a sediment veneer that appears to periodically move, exposing areas of pavement reef. Sessile benthic organisms that require hard substrates for attachment, such as gorgonians, are frequently seen emerging through a shallow veneer of sand. This type of substrate (sediment veneer) with sparse filter feeder communities is common throughout this area (SKM 2009, Rio Tinto 2009, BHPBIO 2011).

3.5. Plankton

Plankton abundance and distribution is patchy, dynamic, and strongly linked to localised and seasonal productivity (Trebilco et al. 2021). 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. As a key indicator for ecosystem health and change, plankton distribution and abundance has been measured for over a century in Australia (Richardson et al. 2015). The compilation of this data has been made publicly available through the Australian Ocean Data Network (Australian Ocean Data Network 2022) and has been used in the Australia State of the Environment 2021 report (Trebilco et al. 2021) to nationally assess marine ecosystem health. According to their findings, primary production has decreased in the north-west and north-east shelf and offshore in the Indian Ocean.

Within the EMBA, peak primary productivity varies on a local and regional scale. In general, peaks are linked to mass coral spawning events, peaks in zooplankton and fish larvae abundance and periodic upwelling. Regional upwelling is most common close to the coast and where surface waters diverge. Despite the suppression of major upwelling along the WA coast by the Leeuwin Current, known key upwelling regions include the Ningaloo region (Hanson & McKinnon 2009) and Cape Mentelle (Pattiaratchi 2007). It is also expected that a high abundance of plankton will occur within areas of localised upwelling in the EMBA where the seabed disrupts the current flow.

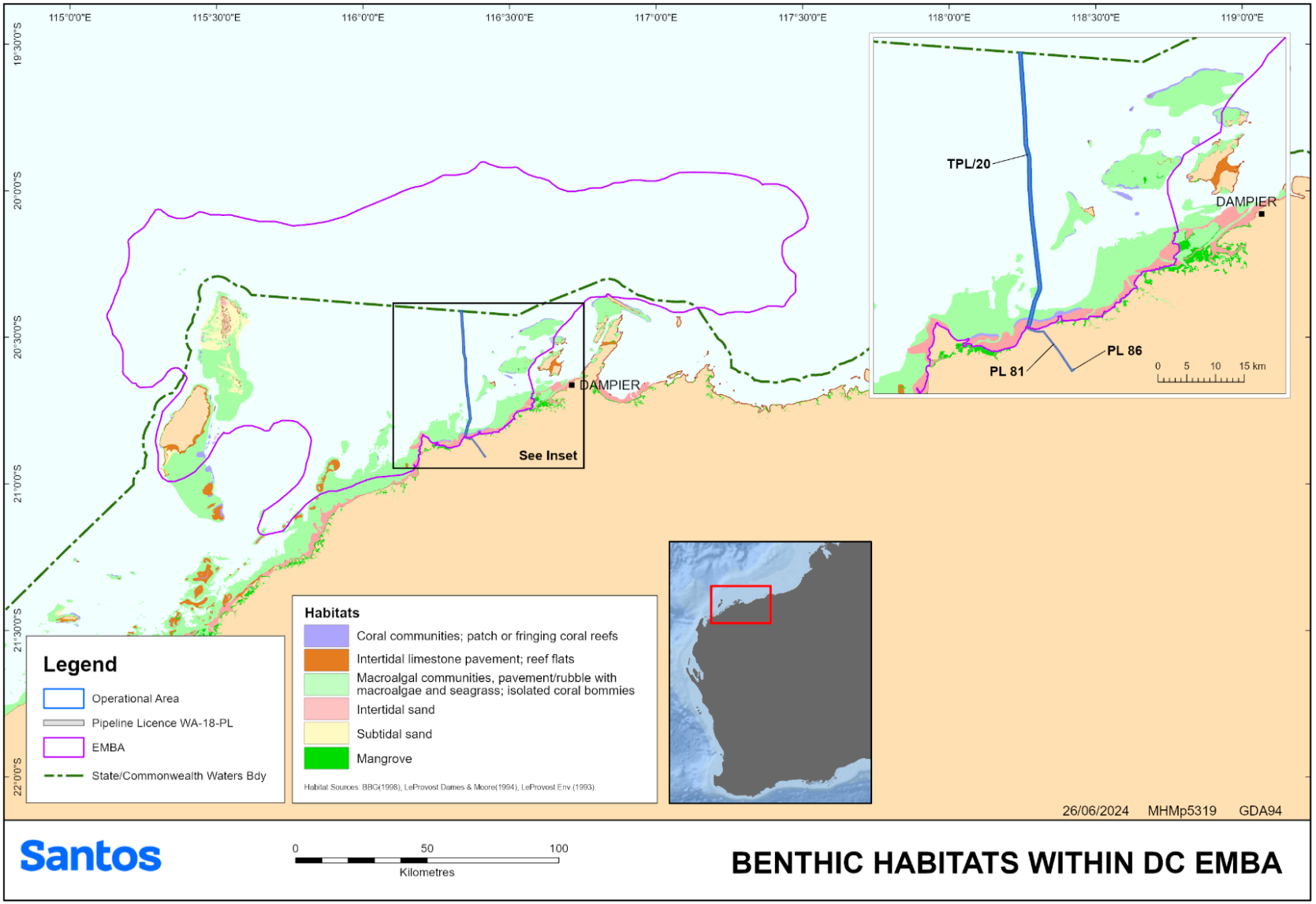


Figure 4: Benthic habitats within DC EMBA

4. Terrestrial Habitats

The terrestrial fauna habitats found onshore in the operational area are typical of those found in the Pilbara Region. The onshore pipelines reside within the Littoral, Cheerawarra and Horesefalt land systems, which are defined as coastal mudflats, clay plains and sandy coastal plains. Shoreline habitat types found within the regional area include mangroves, sandy beaches, intertidal and subtidal zones and rocky shorelines (Figure 4).

Vegetation within the onshore operational area includes two communities that are on the WA list of priority ecological communities (PECs):

- Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (PEC 1); and
- Stony Chenopod associations of the Roebourne Plains (PEC 2).

Locations of these PECs in relation to the DC pipeline are shown in Figure 5 and indicate the pipeline intercepts a very small portion of both of these PECs. Both priority ecological communities are listed as Priority 1 by the Department of Biodiversity Conservation and Attractions (DBCA), defined as being

- 'poorly-known ecological communities: Ecological communities that are known from very few occurrences with a very restricted distribution'; and
- 'occurrences are believed to be under threat either due to their limited extent or being on lands under immediate threat (e.g., within agricultural or pastoral lands)'.

The Roebourne Plains coastal grasslands with gilgai micro-relief occur on deep cracking clays that are self-mulching and emerge on depositional surfaces (DBCA, 2019). The Roebourne Plains gilgai grasslands occur on microrelief of deep cracking clays, surrounded by clay plains/flats and sandy coastal and alluvial plains. The gilgai depressions supports ephemeral and perennial tussock grasslands dominated by Sorghum sp. and *Eragrostis xerophila* (Roebourne Plains grass) along with other native species including *Astrebla pectinata* (barley mitchell grass), *Eriachne benthamii* (swamp wanderrie grass), *Chrysopogon fallax* (golden beard grass) and *Panicum decompositum* (native millet). Threats identified for this PEC include grazing, clearing for mining and infrastructure and urban development, weed invasion and basic raw material extraction.

The Stony Chenopod association of the Roebourne Plains area is dominated by *Eragrostis xerophila* and chenopods growing in saline clay soils with dense surface strew of pebbles and cobbles (DBCA, 2019). The association appears to be uncommon and is likely to be linked with the Cheerawarra land system. Only one occurrence has been located to date (Roebourne Airport), however it is likely some other small areas remain. Threats include grazing, clearing, and weeds especially buffel grass.

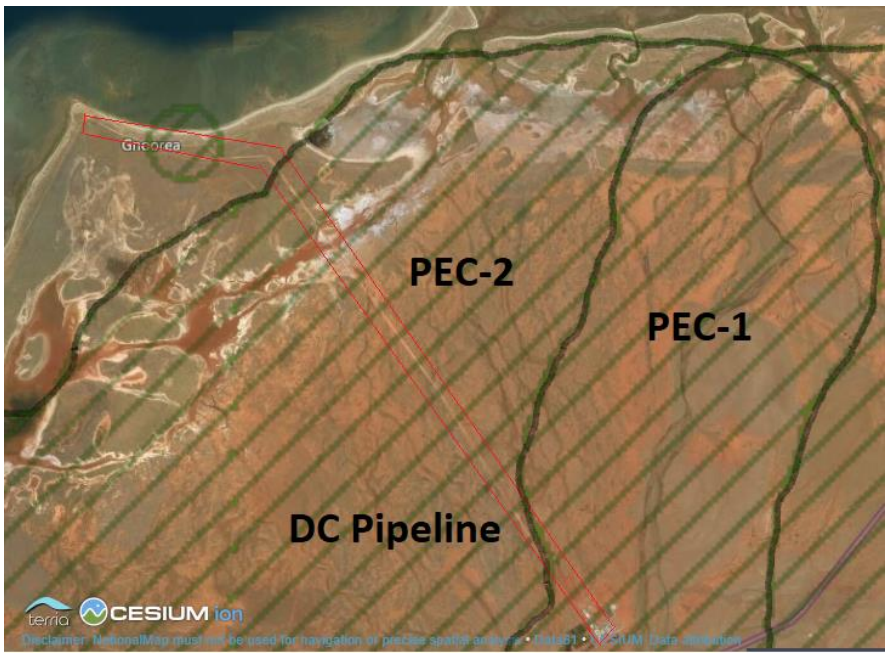


Figure 5: Location of the Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays (PEC 1), and the Stony Chenopod associations of the Roebourne Plains (PEC 2) in relation to the DC pipeline (DBCA, 2019).

A monitoring program assessing the health of onshore vegetation association has been carried out biannually since the third quarter of 2009. Monitoring has indicated that changes in health are related to 'seasonal' factors, largely rainfall, and that there has been no adverse impact from Santos activities. In August 2013, monitoring identified that the pipeline easement rehabilitation transects shared 50% of species with the analogue transects, after having reached 57% in June 2012 (AEL, 2013). Vegetation monitoring has now ceased in accordance with advice from the regulator.

As described above, the vegetation within the operational area was cleared in accordance with MS 795. Areas of vegetation clearing were then rehabilitated in accordance with the conditions of MS 795 and weed and vegetation management activities have been undertaken.

The OEPA undertook an on-site audit in October 2013. It was noted during the audit that there are external pressures impacting on the pipeline easement rehabilitation. These pressures and associated impairment of rehabilitation efforts include public vehicle access, road maintenance activities and cattle. These are activities that are not directly linked to Santos' activities and are beyond its management control. The vegetation within the operational area is considered low quality.

A search of the Australian Soil Resource Information System has confirmed that there is a low-moderate probability of acid sulphate soils being present within the onshore operational area.

4.1. Terrestrial Flora

There are no Declared Rare Flora within the operational area or EMBA.

While the species *Eremophila forrestii subsp forrestii* has no formal conservation status, discussions between investigating botanists and the WA Department of Water and Environmental Regulation (DWER) confirmed that the heath form of this species and its location, at the northern-most extent of its range in this location, is significant (AES, 2007).

No Declared Weeds were found during the environmental assessment phase of the DCGP project.

The construction of the DC supply pipeline was completed in June 2010 and was immediately followed by rehabilitation of the impacted area, which is adjacent to Forty Mile Beach Road. Rehabilitation works occurred over approximately 24 hectares and included ripping and respreading of stored topsoil over the cleared pipeline easement. Since September 2010, monitoring has been undertaken annually to progress against the requirements of Ministerial Statement 795 (MS 795), Condition 6-1, within three years.

Santos has now completed rehabilitation monitoring along the gas pipeline easement and met the conditions of MS 795.

Weed cover has been calculated as the distance of plant cover along the line intercept transect, multiplied by the estimated percentage foliar cover. Average weed cover was compared among rehabilitation and analogue sites using a linear model. Although average weed cover was higher in rehabilitation transects than in analogue transects, the variation amongst weed levels meant that a statistically significant difference between the treatments could not be demonstrated (AES, 2013). In August 2013, monitoring identified that the pipeline easement rehabilitation transects shared 50% of species with the analogue transects, after having reached 57% in June 2012.

As mentioned above, the OEPA undertook an on-site audit in October 2013. It was noted during the audit that there are external pressures impacting on the pipeline easement rehabilitation. These external pressures include public vehicle access, road maintenance activities and cattle as well as presence of invasive species which are not a result of Santos' activities and beyond its management control.

Buffel grass (Cenchrus ciliaris) is dominant within the onshore gas supply pipeline corridor; however, the distribution and abundance of this weed is consistent with the existing proliferation prior to project commencement (AES, 2013).

5. Shoreline and Intertidal 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 following section broadly categorises shoreline habitats as the following biological communities; mangroves, intertidal mud/sand banks, beaches, and rocky shores. These communities are discussed in terms of the IMCRA v. 4.0 bioregion where relevant and where information is available. Figure 4 broadly illustrates these habitats within the Northwest Shelf Province.

5.1. Mangroves

Mangroves commonly occur in sheltered coastal areas in tropical and sub-tropical latitudes (Kathiresan and Bingham 2001). At most locations the dominant mangrove (in terms of area of intertidal zone occupied) is *Avicennia marina*, with the stilt rooted mangrove *Rhizophora stylosa* often occurring as thin zones of dense thickets within the broad zone of *A. marina*. Mangroves are found wherever suitable conditions are present including wave dominated settings of deltas, beach/dune coasts, limestone barrier islands and ria/archipelago shores (Semeniuk 1993). Mangrove plants have evolved to adapt to fluctuating salinity, tidal inundation and fine, anaerobic, hydrogen sulfide rich sediment (Duke et al. 1998).

Mangroves are recognised as significant as productive coastal forest systems, providing habitat and shelter for infauna, epifauna, gastropods, crustaceans, fish and other marine species. Mangroves are important nursery areas for fish, lobster and prawn species, some of which are targeted by recreational and commercial fishers (Department of Environment and Conservation (DEC, 2007). Mangroves may also provide shelter for other species such as juvenile turtles (DEC, 2007). Ospreys (*Pandion haliaetus*) and white-bellied sea eagles (*Haliaeetus leucogaster*) roost in mangroves, while Brahminy kites (*Haliastur indus*) and a range of smaller birds nest in them (DEC, 2007). Mangroves are also recognised for their capacity to protect coastal areas from erosion due to storms and storm surge.

The regional mangroves of mainland and islands from Exmouth to Broome represent Australia's only 'tropical-arid' mangroves. There are no unusual, endemic or restricted mangrove species in WA; all species are common and widespread elsewhere, either in northern Australia, or in the Indo-Pacific region proximal to northern Australia.

Mangroves are most abundant and diverse in embayments and connective tidal lands, which feature along the Pilbara coast. Generally, most mangrove stands have more than one species. *Avicennia marina* is the most abundant species in the Pilbara, and forms a sparse, single-species stand on the western face of Gnoorea Point (Plate 1).

Mangroves are found in extensive stretches along many creeks and watercourses on the mainland coast. They are also found on the Montebello and Lowendal islands, along the south eastern and southern shores of Barrow Island and in sheltered pockets on the offshore islands of the Dampier Archipelago.

Plate 1: Gnoorea Point mangroves

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

locations (National Oceanic and Atmospheric Administration (NOAA) 2010). The intricate matrix of fine roots within the soil also binds sediments together.

Mangroves play an important role in connecting the terrestrial and marine environments (Alongi 2009). Numerous studies (e.g. Nagelkerken et al. 2000, Alongi 2002, Alongi 2009, Kathiresan and Bingham 2001) have shown mangroves to be highly productive and an important breeding and nursery areas for juvenile fish and crustaceans, including commercially important species (Kenyon et al. 2004). They also provide habitat for many juvenile reef fish species.

Mangroves also play an important ecosystem role in nutrient cycling and carbon fixing (NOAA 2010). The trees absorb carbon dioxide from the atmosphere and the organic matter such as fallen leaves forms nutrient rich sediments creating a peat layer that stores organic carbon (Alongi 2009, Ayukai 1998).

The muddy sediments that occur in mangrove forests are home to a variety of epibenthic, infaunal and meiofaunal invertebrates (Kathiresan and 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 estuary, 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 also 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 and Crowley 2000).

The two key State regulatory documents relevant to the protection and management of mangroves in WA are:

- EPA (2001) Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline. Guidance Statement No. 1
- EPA (2016) Technical Guidance – Protection of Benthic Communities and Habitats.

5.1.1. Northwest Shelf Province

In the Pilbara region, the coast is a complex of deltas, limestone barrier islands and lagoons, with a variable suite of substrates. As a result, mangroves in this region form relatively diverse fringing stands, albeit often stunted in stature but at times quite extensive in area. The mangroves along the Pilbara coastline are the largest single unit of relatively undisturbed tropical arid zone habitats in the world. The area has nine mangrove taxa and a total of 632 km^2 mangroves (MangroveWatch 2014). As with most arid zone mangroves, Pilbara mangroves are characterised by open woodlands and shrublands that are of relatively lower productivity than the mangrove communities of the wet tropics because of the extreme water and salinity stresses that affect the intertidal zone in the Pilbara (EPA 2001). Significant stands of mangroves in the Pilbara include:

- Exmouth Gulf: mangrove assemblages within the Bay of Rest on the western shore of the Gulf and the extensive mangrove system on the eastern shore of the Gulf that extends as a series of tidal flats and creek channels from Giralia Bay to Yanrey Flats (Astron 2014). These areas of mangrove are also designated as ‘regionally significant’ by the EPA (2001). The importance of these mangroves to the Exmouth Prawn Fishery is discussed in Kangas et al. (2006)
- Mainland coast and nearshore islands: mangrove assemblages at Ashburton River Delta, Coolgra Point, Robe River Delta, Yardie Landing, Yammadery Island and the Mangrove Islands are all designated as ‘regionally significant’ by the WA EPA (2001) and the EPA will give these mangrove formations the highest degree of protection with respect to geographical distribution, biodiversity, productivity and ecological function
- Montebello, Barrow and Lowendal Islands: mangrove assemblages all lay within designated reserves. The mangrove communities of the Montebello Islands are considered globally unique as they occur in lagoons of offshore islands (DEC 2007). Mangrove stands identified on Varanus Island occur on the west coast in discrete patches within the tidal and supratidal zones, at South Mangrove Beach and a small embayment (Astron 2016). Mangrove stands on Varanus Island have been identified as healthy, with similar stands also identified as present on Bridled Island to the north of Varanus Island (Astron 2016).

Rhizophora stylosa and *Avicennia marina* are the most common mangrove species along the WA Coast.

5.2. Intertidal Mud/Sand Flats

Intertidal mudflats form when fine sediment carried by rivers and the ocean is deposited in a low energy environment. Tidal mudflats 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 which ensures a more constant food supply (Robertson 1988).

Intertidal sand and mudflats support a wide range of benthic infauna and epifauna which graze on microscopic algae and microbenthos, such as 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 shellfish which swim over the area at high tide. Mudflats have also been shown to be significant nursery areas for flatfish. In addition, during high tide, the intertidal sand flats provide foraging habitats for sharks and shovelnose rays (DEC, 2007).During low tide, these intertidal areas are also important foraging areas for indigenous and migratory shorebirds. Mudflats also play a vital role in protecting shorelines from erosion (Wade and Hickey 2008).

Shielded habitats of sand, silt or mud in protected environments that collect deposited marine sediments are located on the western side of Gnoorea Point, and the eastern side of Pelican Point. Further afield, they are also found in the Montebello Islands. Some areas exist on the eastern and southern shore of the adjacent Barrow Island (DEC, 2007). This habitat type is not extensive; however, due to the high diversity of infauna (particularly molluscs) found in this habitat, it is important for biodiversity conservation. The habitat type is generally not found in the Dampier Archipelago, but these communities do exist in the northern half of the Ningaloo Marine Park associated with mangrove communities (Department of Conservation and Land Management (CALM) & Marine Parks and Reserves Authority (MPRA), 2005).

Intertidal habitats support a diverse assemblage of vertebrates and invertebrates, particularly in vegetated areas. Coral reef communities located in the intertidal zone include the reef crest, shallow reef fronts, reef flat and shallow back reef zones with a variation in live coral and macroalgal coverage. Subtidal communities include the upper seaward reef slope, sheltered back reef, deep lagoonal reef and bommie clusters with a high percentage of hard corals, macroalgae and coralline algae (Bancroft, 2003). Intertidal platforms can support extensive macroalgal communities with a range of faunal diversity, including sponges, ascidians and soft corals (Chevron Australia, 2010).

5.3. Intertidal Platforms

Intertidal platforms are areas of hard bedrock and/or limestone with or without a sediment veneer of varying thickness. These platforms can vary from low to high relief and provide a habitat for a diverse range of intertidal organisms (Morton and Britton in Jones 2004, SKM 2009, 2011, Hanley and Morrison 2012) and some species of shore birds (Garnet and Crowley 2000). They are common within each of the coastal bioregions within the EMBA.

5.3.1. Northwest Shelf Province

Large tidal regimes are likely to be the defining environmental factor influencing the distribution of intertidal flora and fauna in the Northwest Shelf Province and Northwest Shelf Transition. The intertidal area of the Kimberley has an extreme tidal range (hypertidal) which creates unique environmental conditions and habitats not seen else anywhere else in the world. As a remote area many of the habitats are untouched and they are recognised as having significant conservation value (DPaW 2013). DPaW (2013) reports that as a result of the monsoonal influxes of freshwater and land-derived nutrients distinctive tropical marine ecosystems have occurred.

5.4. 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 beaches are found across the EMBA and vary in length, width, and gradient. They are interspersed among areas of hard substrate (e.g. sandstone) that form intertidal platforms and rocky outcrops. There is a wide range of variation in sediment type, composition, and grain size along the EMBA.

Sandy beaches provide habitat to a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds (Garnet and Crowley 2000). The number of species and densities of benthic macroinvertebrates that occur in the sand are typically inversely correlated with sediment grain-size and exposure to wave action, and positively correlated with sedimentary organic content and the amount of detached and attached macrophytes (Wildsmith et al. 2005). However, the distributions of these faunas among habitats will also reflect differences in the suite of environmental variables that characterize those habitats (Wildsmith et al. 2005).

Sandy habitats are important for both resident and migratory seabirds and shorebirds (refer **Section 1**). 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*) a crab eater, are commonly associated with sandy beaches (Garnet and Crowley 2000). Sandy beaches can also provide an important habitat for turtle nesting and breeding (see marine turtles **Section 7.1**).

Sandy beaches can also provide an important habitat for turtle nesting, particularly at Barrow, Montebello and Lowendal islands.

Sandy habitats are also important for birds at the Montebello and Lowendal islands. For example, oyster catchers and ruddy turnstones feed along beaches and rocky shorelines, while crested terns are known to nest on sandy beaches.

5.5. Rocky Shorelines

Rocky shorelines are found across the EMBA and are often indicative of high energy areas (wave action) where sand deposition is limited or restricted (perhaps seasonally or during a cyclone). They are formed from limestone pavement extending out from the beach into subtidal zones, for example along the Ningaloo Coast and North West Cape; higher relief platforms (>0.5 m off high water mark) are also present at a number of headlands along the North West Cape.

Rocky shores can include pebble/ cobble, boulders, and rocky limestone cliffs (often at the landward edge of reef platforms). Rocky outcrops typically consist of hard bedrock, but some of the coastline has characteristic limestone karst cliffs with an undercut notch. Rocky shorelines can vary from habitats where there is bedrock protruding from soft sediments to cliff like structures that form headlands. Rocky shorelines are an important foraging area for seabirds and habitat for invertebrates found in the intertidal splash zone (Morton and Britton cited in Jones 2004). For example, oyster catchers and ruddy turnstones feed along beaches and rocky shorelines (see seabirds in Section 10.2.2).

6. Fishes and Sharks

Fish distributions in the EMBA are discussed with respect to the IMCRA Provincial Bioregions which were defined using CSIRO's 1996 regionalisation of demersal fish on the continental shelf to the shelf break, and their 2005 regionalisation of demersal fish on the continental slope to approximately 1,200 m depth (DEH 2006). The EPBC species listed as threatened and migratory found in the EMBA, according to the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP), are shown in Table 1, along with their WA conservation listings (as applicable) and discussed below.

The following WA conservation codes apply to WA conservation significant fauna:

- Threatened species (listed under the *Biodiversity Conservation Act 2016* (WA) (BC Act)):
  - Critically endangered
  - Endangered
  - Vulnerable
- Specially protected species (listed under BC Act):
  - Migratory
  - Species of special conservation interest (conservation dependant fauna)
  - Other specially protected species
- Priority species (non-statutory state based administrative process):
  - Priority 1, 2 and 3: poorly-known species – possible threatened species that do not meet survey criteria or are otherwise data deficient. Ranked in order of priority. In urgent need of further survey.
  - Priority 4: species that are adequately known, are either: rare but not threatened; meet criteria for near threatened; or delisted as threatened species within last five years for reasons other than taxonomy. Requiring regular monitoring.

A detailed account of commercial and recreational fisheries that operate in the region is provided in the Commercial Fisheries Section 16.6 and detailed in *The State of the Fisheries Report* 2021/2022 (Newman et al., 2023).

Table 1: EPBC listed fish and shark species in the EMBA

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA[1] in EMBA
	EPBC Act 1999	BC Act 2016[2]	Other WA Conservation Code	TPWC Act 1976		
Cape range cave gudgeon, Blind gudgeon (*Milyeringa veritas)*	Vulnerable	Vulnerable	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Grey nurse shark (*Carcharias taurus*)	Vulnerable	Vulnerable	-	Listed nationally	Congregation or aggregation known to occur within area.	None - BIA not found in EMBA
White shark, Great white shark (*Carcharodon carcharias*)	Vulnerable & Migratory	Vulnerable	-	-	Species or species habitat may occur within area.	None – BIA not found in EMBA
Whale shark (*Rhincodon typus*)	Vulnerable & Migratory	Migratory	-	Listed nationally	Foraging or related behaviour known to occur within area.	Yes – Refer to **Table 3**
Dwarf sawfish, Queensland sawfish *(Pristis clavata*)	Vulnerable & Migratory	Migratory	Priority 1	Vulnerable	Species or species habitat known to occur within area	None – BIA not found in EMBA
Freshwater sawfish, Largetooth sawfish, River sawfish, Leichhardt's sawfish, Northern sawfish (*Pristis pristis)*	Vulnerable & Migratory	Migratory	Priority 3	Vulnerable	Species or species habitat may occur within area	None – BIA not found in EMBA
Narrow sawfish, Knifetooth sawfish (*Anoxypristis cuspidata*)	Migratory	Migratory	-	-	Species or species habitat likely to occur within area.	None - No BIA defined
Green sawfish, Dindagubba, Narrowsnout sawfish (*Pristis zijsron*)	Vulnerable & Migratory	Vulnerable	-	Vulnerable	Species or species habitat known to occur within area	None – BIA not found in EMBA
Oceanic whitetip shark (*Carcharhinus longimanus*)	Migratory	-	-	-	Species or species habitat likely to occur within area.	None – BIA not found in EMBA
Shortfin mako, Mako shark (*Isurus oxyrinchus*)	Migratory	Migratory	-	-	Species or species habitat likely to occur within area.	None – BIA not found in EMBA
Longfin mako (*Isurus paucus*)	Migratory	Migratory	-	-	Species or species habitat likely to occur within area.	None - No BIA defined
Reef manta ray, Coastal manta ray (*Manta alfredi*)	Migratory	Migratory	-	-	Species or species habitat known to occur within area.	None - No BIA defined
Giant manta ray (*Manta birostris*)	Migratory	Migratory	-	-	Species or species habitat likely to occur within area.	None - No BIA defined
Scalloped hammerhead shark (*Sphyrna lewini)*	Conservation Dependent	-	-	Listed nationally	Species or species habitat known to occur within area	None - No BIA defined
Southern bluefin tuna *(Thunnus maccoyii)*	Conservation Dependent	-	-	-	Species or species habitat likely to occur within area Breeding known to occur within area	None - No BIA defined

[1] Biologically Important Area
[2] The Wildlife Conservation (Specially Protected Fauna) Notice 2018 has been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of threatened, extinct and specially protected species under Part 2 of the BC Act.

6.1. Regional Surveys

Within the EMBA a number of important geographical areas for fish exist, including Montebello/Barrow Island Marine Park.

6.1.1. Northwest Shelf Province

The demersal zone of the North West Shelf (which includes the Northwest Province and Northwest Shelf Province) hosts a diverse assemblage of fish of tropical Indo-west Pacific affinity, with up to 1,400 species known to occur, with a great proportion of these occurring in shallow coastal waters (Allen et al. 1988). Last et al. (2005) and Fox and Beckley (2005) described the North-west Province as being characterised by a high level of endemism and species diversity. Certain areas of increased biological activity (e.g. Glomar Shoals) attract demersal fish species such as Rankin cod, red emperor, crimson snapper and spangled emperor that are exploited by commercial trawl and trap fisheries (Sainsbury et al. 1992, Fletcher and Santoro 2013).

The shallow waters (<30 m) of the Dampier Archipelago, in the Northwest Shelf Province, support a characteristic and rich fish fauna of 650 species from a variety of habitats including coral and rocky reefs, mangroves, sand and silty bottoms and sponge gardens (Hutchins 2003 & 2004). The majority of these species are found over hard substrate, but significant numbers are also found from soft bottom and mangrove areas. The outer islands of the Archipelago are inhabited predominantly by coral reef fishes whereas inner areas close to the mainland are occupied by mangrove and silty-bottom dwellers. The inter-island passages have a relatively rich soft bottom fauna. EPBC Act protected fish species within the Dampier Archipelago include the dwarf sawfish (*Pristis clavata*), freshwater sawfish (*Pristis pristis*) and narrow sawfish (*Anoxypristis cuspidate*).

The fish fauna of the archipelago is less diverse than the islands of the West Pilbara to the south but are closely related to the fauna at the offshore Montebello Islands (Hutchins 2004). The fish fauna of Barrow/ Lowendal/ Montebello Islands are widespread throughout the Indo-west Pacific region.

Within the southern portion of the Northwest Shelf Province, small pelagic fish (e.g. lantern fishes) comprise a third of the total fish biomass (Bulman 2006) and inhabit a range of marine environments, including inshore and continental shelf waters. These small pelagic fish play an important ecological role, not only for this particular area but for the entire NWMR. They feed on pelagic phytoplankton and zooplankton and provide a food source for a wide variety of predators such as marine mammals, sharks, large pelagic fish and seabirds, thus providing a vital link between many of the region's trophic systems (Mackie et al. 2007).

Pelagic fish in the Northwest Shelf Province include tuna, mackerel, herring, pilchard and sardine, and game fish such as marlin and sailfish (BBG 1994, Brewer et al. 2007), some of which are targeted by both commercial and recreational fishers. In particular, adult and juvenile southern bluefin tuna are thought to migrate through the North West Shelf on their way to and from spawning grounds in the north-eastern Indian Ocean. However, the timing of these migrations and the use of regional currents to assist their migration is still unclear. The oceanic waters of the North West Shelf are also believed to provide important spawning and nursery grounds for a number of large pelagic fish species. **Table 2** provides a summary of the key fish species and likely timing of their spawning in the region (DoF correspondence).

Table 2: Spawning and aggregation times of key commercially caught fish species within the North West Shelf

Species		Month											
Species Common Name	**Species Latin Name**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Blacktip shark	*Carcharhinus tilstoni* and *C. limbatus*	■										■	■
Goldband snapper	*Pristipomoides multidens*	■	■	■	■	■					■	■	■
Rankin cod	*Epinephelus multinotatus*		■	■			■	■	■	■	■	■	■
Red emperor	*Lutjanus sebae*	■	■	■	■	■	■		■	■	■	■	■
Sandbar shark	*Carcharhinus plumbeus*		■		■								
Spanish mackerel	*Scomberomorus commerson*									■	■	■	■
Pink snapper	*Pagrus auratus*					■	■	■					
Baldchin groper	*Choerodon rubescens*	■	■							■	■	■	■
Crystal (snow) crab	*Chaceon* spp.	■	■	■	■	■	■	■	■	■	■	■	■
King George whiting	*Sillaginodes punctatus*						■	■	■	■			
Spangled emperor	*Lethrinus nebulosus*									■	■	■	■
Pearl oyster	*Pinctada maxima*		■	■	■					■	■	■	■
Blue-spotted emperor	*Charaxes cithaeron*	■	■	■				■	■	■	■	■	■
Dusky whaler	*Carcharhinus obscurus*	May occur throughout the year											
Whiskery shark	*Furgaleus macki*								■	■	■		
Gummy shark	*Mustelus antarcticus*	Peak pupping periods unknown											
Fish	Other species	Timing of spawning activity varies between species											

6.2. Fish Species

Two species of fish listed as Threatened under the EPBC Act (**Table 1**) were identified in the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP):

- Blind gudgeon (*Milyeringa veritas*)
- Southern bluefin tuna *(Thunnus maccoyii)*

6.2.1. Blind Gudgeon

The blind gudgeon (*Milyeringa veritas*) is known to occur on the Cape Range Peninsula (in the Central Western Shelf Transition) (Humphreys and Feinberg 1995), and a related species of the genus Milyeringa, the Barrow cave gudgeon *(Milyeringa justitia*) has also been noted at Barrow Island (Humphreys 1999). The Barrow cave gudgeon is listed as Vulnerable under the WA BC Act. They have been recorded in waters ranging from fresh to seawater at depths of up to 33 m in caves and 50 m in wells and bores. Both species are restricted to either caves or groundwater (Humphreys and Blyth 1994) and are the only two vertebrate animals known from Australia for this (DoE 2014a).

6.2.2. Southern Bluefin Tuna

The southern bluefin tuna (SBT; *Thunnus maccoyii)* is listed as conservation dependent under the EPBC Act and may be found within the EMBA (DCCEEW, 2024c). In Australia, SBT are distributed throughout temperate and tropical waters, primarily from northern WA through southern Australia, with a spawning ground identified between Java and northern WA. As the species is long-lived and slow to mature, it is vulnerable to overfishing and stocks have undergone a significant decline. As SBT are pelagic and highly migratory, and are commercially targeted internationally, a cooperative management approach was necessary to manage the fishery. Established in 1995, the Commission for the Conservation of Southern Bluefin Tuna utilises an international approach to manage the status of the species, through national allocations of total allowable catch and prescribing additional management measures as required (DCCEEW, 2024c).

No southern bluefin tuna BIAs were identified in the EMBA.

6.3. Sharks, Rays and Sawfishes

The diversity of marine environments in the waters within the NWMR has led to a rich fauna of cartilaginous fish (sharks and rays). Of the approximately 500 shark species found worldwide, 19% (94) are found in the region (DEWHA 2008a). The EPBC Act Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP) identified four species of shark and three species of sawfishes listed as threatened within the search area between southwest WA and northern NT (**Table 1**), including:

- Grey nurse shark (*Carcharias taurus*)
- Great white shark (*Carcharodon carcharias*)
- Whale shark (*Rhincodon typus*)
- Dwarf sawfish (*Pristis clavata*)
- Freshwater sawfish (*Pristis pristis*)
- Green sawfish (*Pristis zijsron*)
- Scalloped hammerhead shark (*Sphyrna lewini)*

Eleven sharks and rays are specially protected as migratory under the BC Act 2016 in the EMBA.

Stingrays are found in Australia's coastal waters throughout the EMBA, primarily occupying shallow benthic habitats. Some nearshore and intertidal habitats, particularly in regions of northern Australia that experience greater tidal ranges, have been identified as important nursery areas for many of these species (DBCA 2014).

The Biologically Important Areas (BIAs) for relevant species detailed above are illustrated in Figure 6.

6.3.1. Grey Nurse Shark

The grey nurse shark (*Carcharias taurus*) is listed as vulnerable under the EPBC Act and the BC Act and may be found within the EMBA. In Australia, the grey nurse shark is now restricted to two populations, one on the east coast from southern Queensland to southern NSW and the other is predominantly found around the southwest coast of WA but has been recorded on the North West Shelf (DEWHA 2012b, Pogonoski et al. 2002). It is

believed that the east and west coast populations do not interact, and ongoing research will probably confirm that the populations are genetically different (Last and Stevens 2009).

While it is thought that grey nurse sharks have a high degree of site fidelity, some studies (McAuley 2004) suggest that grey nurse sharks move between different habitats and localities, exhibiting some migratory characteristics. In certain areas grey nurse sharks are vulnerable to localised pressure due to high endemism. The status of the west coast population is poorly understood although they are reported to remain widely distributed along the WA coast and are still regularly encountered, albeit with low and indeterminate frequency (Chidlow et al. 2006).

Grey nurse sharks are often observed hovering motionless just above the seabed, in or near deep sandy-bottomed gutters or rocky caves, and in the vicinity of inshore rocky reefs and islands (Pollard et al. 1996). The species has been recorded at varying depths but is generally found between 15–40 m (Otway & Parker 2000). Grey nurse sharks have also been recorded in the surf zone, around coral reefs, and to depths of around 200 m on the continental shelf (Pollard et al. 1996). Grey nurse sharks feed primarily on a variety of teleost and elasmobranch fishes and some cephalopods (Gelsleichter et al. 1999, Smale 2005).

No grey nurse shark BIAs were identified in the EMBA.

6.3.2. Great White Shark

The great white shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act and is listed as vulnerable under the BC Act. In Australia, great white sharks have been recorded from central Queensland around the south coast to northwest WA but may occur further north on both coasts (Last and Stevens 2009). There are no known aggregation sites for white sharks in the North-west marine region, but the species has been recorded in North West Shelf waters during humpback migrations (DEWHA 2012b). They are widely but not evenly distributed in Australian waters and are considered uncommon to rare compared to most other large sharks (CITES 2004).

Study into great white shark populations is difficult (Cailliet 1996) given the uncertainty about their movements, emigration, immigration and difficulty in estimating the rates of natural or fishing mortality.

Great white sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas (Pogonoski et al. 2002). They also make open ocean excursions and can cross ocean basins (for instance from South Africa to the western coast of Australia and from the eastern coast of Australia to New Zealand). Great white sharks are often found in regions with high prey density, such as pinniped colonies (DEWHA 2009). There are no BIAs for the great white shark in the EMBA.

6.3.3. Whale Shark

The whale shark (*Rhincodon typus*) is listed as vulnerable and migratory under the EPBC Act and is also listed as a specially protected species under the BC Act as a species of special conservation interest (conservation dependent fauna). The species is also classified as vulnerable on the World Conservation Union's Red List of Threatened Species (Norman 2005) and are protected under the WA *Conservation and Land Management Act 1984,* NT TPWC Actand WA *Fish Resources Management Act 1994*.

The whale shark is the largest of all fish (>18 m; Borrell et al. 2011; Chen et al. 1997, Compagno 2001) and is a migratory species with worldwide geographical ranges between 30º N and 35º S (Last and Stevens 2009). Whale sharks are mostly epipelagic, whereby they spend a large amount of time in the top 200 m of the ocean (Tyminski et al. 2015), with a significant portion being spent at surface (<20 m) (Rowat & Brooks, 2012). This leads to an increased potential risk of vessel collision, which has been demonstrated from tracking data of 348 individuals (across all areas of distribution) showing a 92% horizontal and nearly 50% vertical space overlap with persistent large vessel (>300 gross tons) traffic (Womersley et al. 2022). There is a general lack of knowledge on many aspects of whale shark biology, however, the species is known to have a slow rate to sexual maturity, with field-based studies from the Maldives estimating male sexual maturity to be approximately 25 years (Perry et al. 2018), with females potentially maturing even later (Pierce et al. 2021). This 'slow' life-history strategy places whale sharks at increased vulnerability to anthropogenic impacts (Pierce et al. 2021).

The species is oceanic but often forms aggregations in coastal waters at sites throughout the tropics. Typically, these aggregations are seasonal and often coincide with specific productivity events that are a focus of feeding for the animals. For example, whale sharks aggregate to feed on dense swarms of copepods in Baja California (Clark and Nelson 1997), fish spawn off Belize (Heyman et al. 2001) and red crab larvae at Christmas Island (Meekan et al. 2009). However, recent studies analysing fatty acids within whale shark tissue, suggest the species may also feed on benthic food sources, such as floating macroalgae (Meekan et al*.,* 2022; Courturier et al*.,* 2013*; Marcus et al.*, 2016).

One of the best-known aggregation sites for whale sharks occurs along the central and NW coast of Western Australia from March to July and is focused on Ningaloo Reef, within the Exmouth region. The small size and

general absence of female whale sharks from Ningaloo Reef suggests that the region may be important for feeding rather than breeding (Norman and Stevens 2007). The timing of this aggregation coincides with a pulse in seasonal productivity that results in large abundances of tropical krill on which these filter feeding sharks feed (Meekan et al. 2006, Jarman and Wilson 2004). At Ningaloo Reef, whale sharks are often found swimming close to the reef front, within a few kilometres of the shore and in water of less than 50 m deep. A tourist industry based on snorkelling with the sharks in this area has developed over the last 15 years and is now estimated to be worth over $4 million annually to the local economy of the Ningaloo region.

Estimates of the size of the population participating in the Ningaloo aggregation are between 300 and 500 individuals (Meekan et al. 2006), but research indicates that the Ningaloo population of whale sharks is declining (Bradshaw et al. 2007).

Whale sharks are known to be highly migratory with migrations of 13,000 km being recorded (Eckert and Stewart 2001). Research on the migration patterns of whale sharks in the western Indian Ocean, and isolated and infrequent observations of individuals, indicate that a small number of the Western Australian population migrate through the North West Shelf. Wilson et al. (2006) tagged 19 whale sharks in 2003 and 2004, with long term movements patterns successfully recorded from six individuals. All travelled north-east into the Indian Ocean after departing Ningaloo Reef, with one tracked to Ashmore Reef and another to Scott Reef. Whale sharks are occasionally observed from Santos' offshore oil and gas facilities on the North West Shelf (Harriet Alpha and Stag platforms). In general, migration along the northern WA coastline broadly follows the 200 m isobath and typically occurs between July and November (DoE 2015). Whale sharks are well known to occur in the Christmas Island territory. There is evidence that the Christmas Island territory is on the migration route for many individuals, but they are rarely sighted within the Cocos (Keeling) Islands territory.

A common method for monitoring individual whale sharks is the use of variations in spot patterns, which has recently been tested to be 100% successful based on 154 photographic and genetic markers (Meenakshisundaram, 2021).

A biologically important area for whale sharks is located in northern WA, offshore of the Pilbara and Kimberley coastline, and broadly follows the 200 m isobath. The whale shark BIA in the EMBA is detailed in **Table 3** and is shown on Figure 6.

DBCA has a wildlife management program to manage whale shark interactions in reserves - Whale shark management with particular reference to Ningaloo Marine Park, Wildlife Management Program no. 57 (2013).

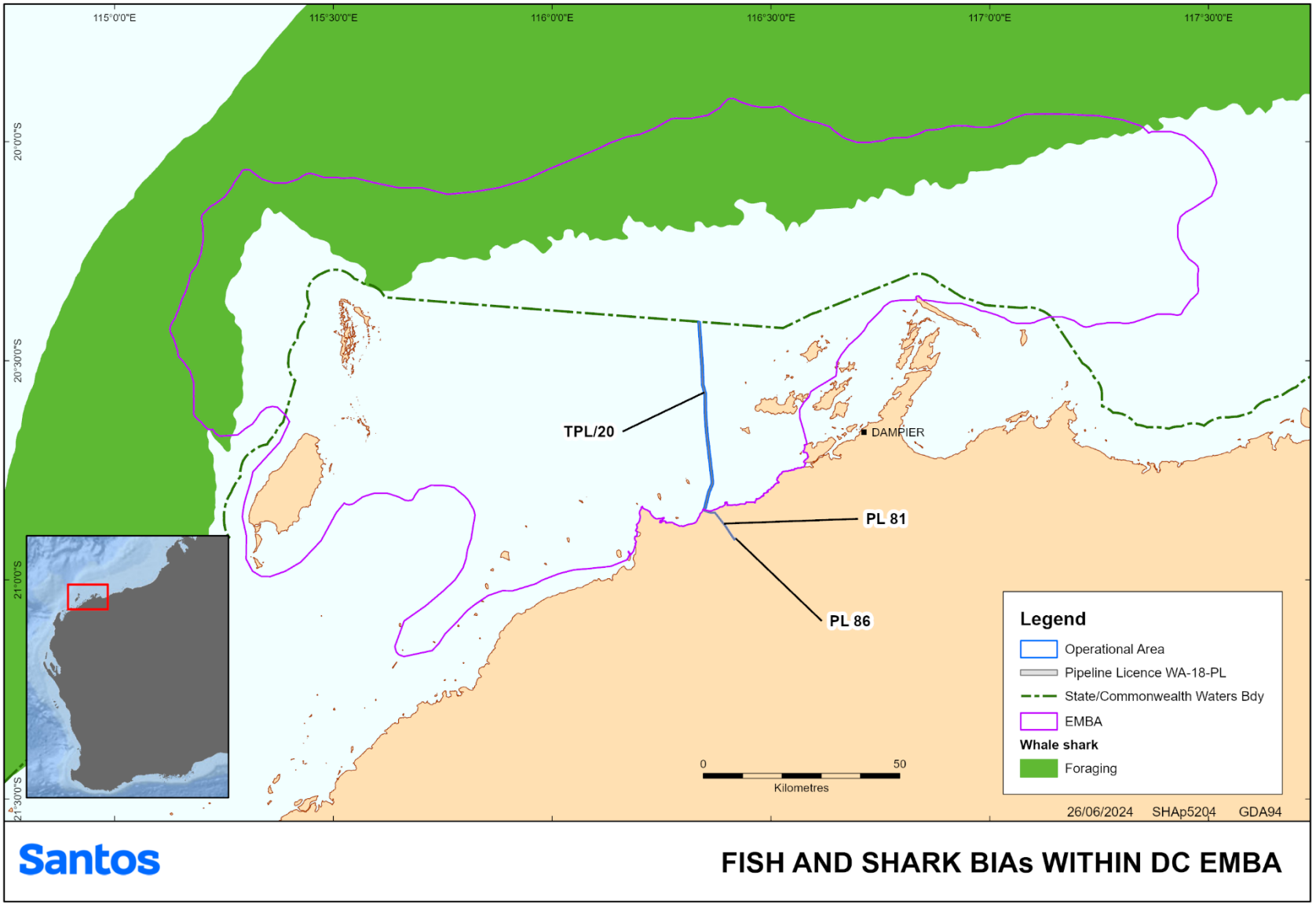


Figure 6: Biologically Important Areas – Whale Shark

6.3.4. Dwarf Sawfish

The dwarf sawfish (*Pristis clavata*) is listed as vulnerable under the EPBC Act and thought to be restricted to Australia (DoE 2014b). It is also listed as a Priority 1 conservation species in WA and as Vulnerable in the NT. The Australian distribution of the dwarf sawfish is considered to extend across northern Australia and along the Kimberley and Pilbara coasts (Last and Stevens 2009, Stevens et al. 2005). However, the majority of records of dwarf sawfish in WA and the NT have come from shallow estuarine waters of the Kimberley region which are believed to be nursery (pupping) areas, with immature juveniles remaining in these areas up until three years of age (Thorburn et al. 2004). Adults are known to seasonally migrate back into inshore waters (Peverell 2007); although it is unclear how far offshore the adults travel as captures in offshore surveys are very uncommon. The species' range is restricted to brackish and salt water (Thorburn et al. 2007).

The recovery plan identifies pupping as known to occur in the King Sound, the Cambridge Gulf and 80 Mile Beach, with pupping likely to occur identified at a number of locations along the Pilbara and Kimberly Plan (Commonwealth of Australia, 2015). Under the associated recovery plan all areas where aggregations of individuals have been recorded displaying biologically important behaviours such as breeding, foraging, resting or migrating are considered critical to the survival of the species unless population data suggests otherwise.

There are no BIAs for sawfish in the EMBA.

6.3.5. Freshwater and Green Sawfish

The freshwater sawfish (*Pristis pristis) (*also previously listed as the Largetooth sawfish*)* and green sawfish (*Pristis zijsron)* are listed as vulnerable under the EPBC Act. The freshwater sawfish is listed as a Priority 3 conservation species in WA, while the green sawfish is listed as Vulnerable under the BC Act and both species are listed as Vulnerable in the NT under the TPWC Act.

The freshwater species are wider-ranging than the dwarf sawfish and are also found in the Indo-west Pacific (DoE 2014c, DoE 2014d). Important areas for sawfishes include King Sound, and the Fitzroy, Durack, Robinson and Ord rivers for the freshwater sawfish; and Cape Keraudren for the green sawfish (Stevens et al. 2008, Thorburn et al. 2007, 2008).

Sawfishes generally inhabit inshore coastal, estuarine and riverine environments. The freshwater sawfish has been recorded in north-west Australia from rivers (including isolated water holes), estuaries and marine environments (Stevens et al. 2005). Newborns and juveniles primarily occur in the freshwater reaches of rivers and in estuaries, while most adult freshwater sawfish have been recorded in marine and estuarine environments (Peverell 2005, Thorburn et al. 2007). It is believed that mature freshwater sawfish enter less saline waters during the wet season to give birth (Peverell 2005) and freshwater river reaches play an important role as nursery areas (DoE 2014c).

The green sawfish has predominantly been recorded in inshore coastal areas, including estuaries and river mouths with a soft substrate, although there have been records of sawfish offshore in depths up to 70 m (Stevens et al. 2005). This species does not occupy freshwater habitats (DoE 2014d).

Short-term tracking has shown that green sawfish appear to have limited movements that are tidally influenced, and they are likely to occupy a restricted range of only a few square kilometres within the coastal fringe, with a strong association with mangroves and adjacent mudflats (Stevens et al. 2008). Sawfishes feed close to the benthos on a variety of teleost fishes and benthic invertebrates, including cephalopods, crustaceans and molluscs (Compagno & Last 1999, Last & Stevens 2009, Pogonoski et al. 2002, Thorburn et al. 2007, 2008).

Baseline surveys undertaken for Chevron's Wheatstone project identified green sawfish habitat and nursery area for juveniles within the north-eastern lagoon of the Ashburton Delta and in Hooley Creek near Onslow. Distribution of sawfish in these creeks is spatially and seasonally variable due to changing tidal and environmental conditions. However, they typically return to inshore waters to breed and pup during the wet season (i.e. January) (Chevron 2011).

There are no BIAs for sawfish in the EMBA.

6.3.6. Scalloped Hammerhead Shark

The scalloped hammerhead shark (*Sphyrna lewini*) is listed as conservation dependent under the EPBC Act and may be found within the EMBA. Globally distributed, in Australia, scalloped hammerhead sharks are found in both coastal and oceanic environments, in warm-temperate to tropical waters typically across the northern coastline. There are no aggregation sites identified for scalloped hammerhead sharks in the EMBA, however juveniles of the species utilise shallower nearshore habitats of northern Australia, and there are some indications that there may be important nursery habitats in the area. As a species that is slow to mature and has low fecundity, the scalloped hammerhead shark is vulnerable to overfishing, with its unique head morphology also increasing its likelihood of

capture as bycatch in net fisheries. Although no longer targeted by commercial fisheries, global population declines have prompted recent changes to national and state-based approaches to stock management, including total allowable catch limits (Northern Territory) or complete prohibition of take (Queensland) (DCCEEW, 2024d).

No scalloped hammerhead shark BIAs were identified in the EMBA.

6.4. Biologically Important Areas / Critical Habitat – Fishes and Sharks

BIAs are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration**.** BIAs are identified by DCCEEW; however, they have no legal status, but are designed to assist decision making under the EPBC Act. They are not designed to identify protected areas but may inform such processes. **Table 3** below provides an overview of BIAs in the EMBA for fish.

The DCCEEW may make recovery plans for threatened fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, and summary of relevant recovery plans is listed in **Section 15.2**. BIAs may overlap these sites but may be identified for other purposes. DCCEEW state that the criteria used to identify 'habitat critical to the survival of the species' are more complex than those used to identify BIA.

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species'. To date no critical habitat in WA has been listed under either Act.

Table 3: Biologically important areas – Fishes and Sharks

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Whale shark	*Rhincodon typus*	Foraging (high density prey) – Ningaloo Reef Foraging – Wider Ningaloo Region	Ningaloo Marine Park and adjacent Commonwealth waters Northward from Ningaloo along 200 m isobath

7. Marine Reptiles

Seven species of listed marine reptiles under the Commonwealth EPBC Act are known to occur in Australian waters in the EMBA, according to the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP). An examination of the species profile and threats database (DoEE 2024) showed that some listed reptile species are not expected to occur in significant numbers in the marine and coastal environments in the EMBA due to their terrestrial distributions. Hence, these species are not discussed further.

Of the reptile species identified in the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP), seven are listed as threatened and five of these are also listed as migratory. These species are show in **Table 4** along with their WA conservation listings (as applicable)[3]. BIAs within the EMBA area discussed in **Table 6**.

Table 4: EPBC listed marine reptile species in the EMBA

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
Green turtle (*Chelonia mydas*)	Vulnerable Migratory	Vulnerable	-	Listed nationally	Aggregation, basking, foraging, internesting, internesting buffer, mating, migration corridor, nesting, and	Yes – refer to **Table 6**

[3] An overview of WA fauna conservation codes is provided in **Section 6** (fish and sharks).

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
					critical habitat known to occur within area	
Flatback turtle (*Natator depressus*)	Vulnerable Migratory	Vulnerable	-	Listed nationally	Nesting, internesting, internesting buffer, foraging, aggregation, migration corridor, and critical habitat known to occur within area	Yes – refer to **Table 6**
Hawksbill turtle (*Eretmochelys imbricata*)	Vulnerable Migratory	Vulnerable	-	Vulnerable	Mating, nesting, internesting, internesting buffer, foraging, migration corridor, and critical habitat known to occur within area	Yes – refer to **Table 6**
Loggerhead turtle (*Caretta caretta*)	Endangered Migratory	Endangered	-	Vulnerable	Internesting buffer and nesting known to occur within area	Yes – refer to **Table 6**
Leatherback turtle (*Dermochelys coriacea*)	Endangered Migratory	Vulnerable	-	Critically Endangered	Breeding likely to occur within area	None – BIA not found in EMBA
Short-nosed seasnake (*Aipysurus apraefrontalis*)	Critically Endangered	Critically Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined
Leaf-scaled seasnake (*Aipysurus foliosquama*)	Critically Endangered	Critically Endangered	-	-	Species or species habitat known to occur within area	None - No BIA defined

7.1. Marine Turtles

Five species of marine turtle occur in, use the waters, and nest on sandy beaches, in and around the EMBA. These are the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), and leatherback turtle (*Dermochelys coriacea*) (**Table 4**).

These five species are listed on the EPBC Act List of Threatened Species as either ‘endangered’ or ‘vulnerable’ and all five species are also listed as ‘migratory’.

A summary of the different habitat types used during the various life stages of marine turtle species identified in the EMBA is given in **Table 5.**

Table 5: Summary of habitat types for the life stages of the five marine turtle species in the EMBA (DSEWPaC, 2012b)

Life Stage		Green turtle	Flatback turtle	Hawksbill turtle	Loggerhead turtle	Leatherback turtle
Post-hatchling		Open ocean pelagic habitats (poorly studied for Australian populations)	Coastal waters (poorly studied for Australian populations)	Open ocean pelagic habitats (poorly studied for Australian populations)	Pelagic (poorly studied for Australian populations)	Pelagic (no data for Australian populations)
Adult	Mating	Offshore from nesting beaches.	Currently unknown for North West Shelf region.	Offshore from nesting beaches.	Little is known for North West Shelf region but expected to occur either en-route or adjacent to nesting beaches.	Not recorded within North West Shelf region.
	Nesting	Typically, high energy, steeply sloped beaches with deep sand and deep-water approach.	Typically, low-energy beaches that are narrow with a low to moderate slope. Beach approach obstructed by broad intertidal mud or limestone platforms.	Typically beaches close to nearshore coral reefs and sediment comprised of coarse sand and coral rubble.	Poorly studied for North West Shelf region by generally prefer high energy, relatively narrow, steeply sloped, coarse-grained beaches.	Not recorded within North West Shelf region.
	Internesting	Shallow coastal waters within several km of nesting beach. Internesting buffers of 20 km identified around all nesting habitats.	Shallow nearshore waters within 5-60 km of nesting beach. Internesting buffers of 40-60 km identified around all nesting habitats.	Shallow coastal waters within several kilometres of nesting beach. Internesting buffers of 20 km identified around all nesting habitats.	Shallow coastal waters within several kilometres of nesting beach. Internesting buffers of 20 km identified around all nesting habitats.	Danger Point, Cobourg Peninsula. 20 km internesting buffer around nesting sites
	Foraging	Neritic habitats associated with seagrass and algae, and mangrove habitats.	Turbid, shallow inshore waters, subtidal, soft-bottomed habitats of the continental shelf.	Subtidal and intertidal coral and rocky reef habitats of the continental shelf.	Subtidal and intertidal coral and rocky reefs, seagrass and deeper soft-bottomed habitats of the continental shelf.	Mostly pelagic but will forage close to shore and over continental shelf in temperate waters.

7.1.1. Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) has a worldwide distribution, living and breeding in subtropical to tropical locations (Limpus 2008b). Breeding aggregations in Australia occur on both the east coast (Queensland and NSW) and the west. The annual nesting population in Western Australia is thought to be 3,000 females annually (Baldwin et al. 2003), and this is considered to support the third largest population in the world (Limpus 2008b). Loggerhead turtles have one genetic breeding stock within Western Australia (Commonwealth of Australia 2017a).

The WA distribution of sandy beach nesting areas extends from Shark Bay to the southern area of the North West Shelf, with occasional late summer nesting crawls recorded as far north as Barrow and Varanus Islands and the Lowendal and Rosemary Islands (DSEWPaC 2012d). Major nesting locations include the Muiron Islands, the Ningaloo Coast south to Carnarvon and the islands around Shark Bay, which includes Dirk Hartog Island, one of the principal nesting and internesting sites in WA (Limpus 2008b). The Recovery Plan for Marine Turtles in Australia (2017) identifies the Muiron Islands (as a principal rookery), and all waters within a 20 km radius as habitat critical to the survival of loggerhead turtles (Commonwealth of Australia 2017a).

Estimates of up to 5,000 female loggerhead turtles have been predicted within the Ningaloo Marine Park and Muiron Islands Marine Management Area (Waayers 2010). Earlier surveys found higher proportions of nesting loggerheads in the southern areas of the reserves (CALM 2005a).

Foraging areas are widespread for loggerhead turtle populations and migrations from nesting to feeding grounds can stretch thousands of kilometres, including feeding grounds as far north as the Java Sea of Indonesia for the WA population (Limpus 2008b). Loggerhead turtles are carnivorous and feed primarily on benthic invertebrates from depths of up to approximately 50 m to near shore tidal areas including areas of rocky and coral reef, muddy bays, sand flats, estuaries and seagrass meadows (Limpus 2008b).

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). Figure 7 illustrates the BIAs and habitat critical (draft) for loggerhead turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

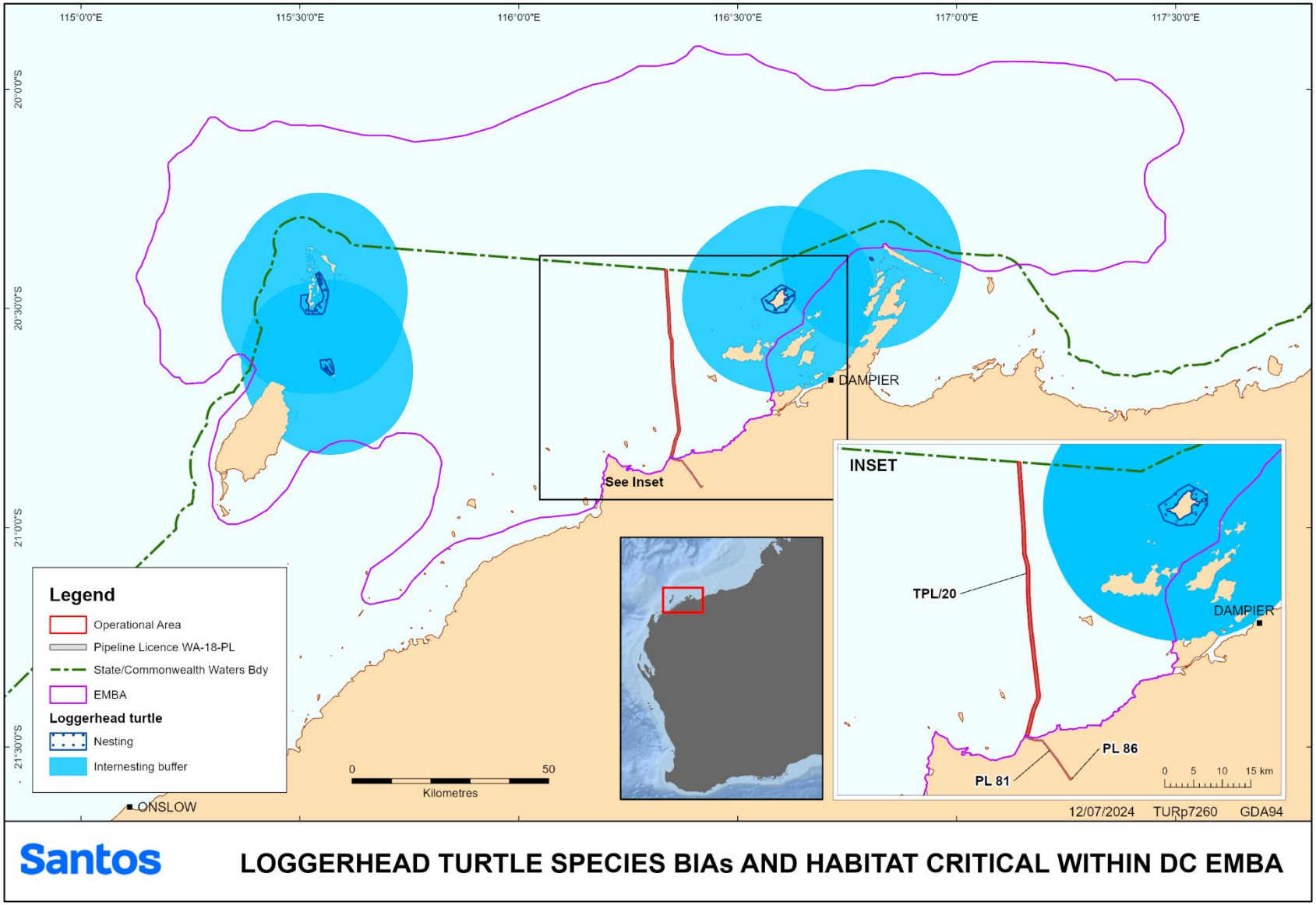


Figure 7: Biologically Important Areas and Habitat Critical – Loggerhead Turtle

7.1.2. Green Turtle

Australian population of green turtles is estimated to be approximately 70,000 and is divided into seven genetically distinct breeding aggregations. The species is widespread and abundant in WA and NT waters with an estimated 20,000 individuals occurring, arguably the largest population in the Indian Ocean (Limpus 2008a). There are three distinct breeding stocks in WA waters which include: the North west Shelf stock, the Scott-Browse stock and the Ashmore Stock (Commonwealth of Australia 2017a).

The North west Shelf population is one of the largest in the world and the most significant rookery is the western side of Barrow Island (Prince 1994, Limpus 2008a). Other principal rookeries include the Lacepede Islands, Montebello Islands, Dampier Archipelago, Browse Island and North West Cape (Prince 1994, Limpus 2008a, DSEWPaC 2012b). See **Table 6** for a complete list.

Surveys by Waayers (2010) within the Ningaloo Marine Park and Muiron Islands Marine Management Area estimated up to 7,500 female green turtles used these areas. In 2014, Santos commissioned a survey of the islands in the Exmouth Region which found that North and South Muiron Islands were significant nesting sites for green turtles with over 100 green turtles nesting overnight on one beach at North Muiron Island (Astron 2014). The green turtle is also known to breed in large numbers in the dunes above the extensive beaches found on Serrurier Island, with counts indicating the island supports the second largest rookery in the Pilbara (Oliver 1990).

Lower density green turtle nesting has also been recorded on Jurabi coast, Thevenard Island, Lowendal Islands and in Exmouth Gulf (Limpus 2008a). Only low numbers of green turtles have been observed nesting on Varanus Island, as well as Airlie Island (Pendoley Environmental 2011). From monitoring undertaken in 2016/17 by Santos on Varanus Island; three green turtles were observed to nest over a four-week tagging effort (Astron 2017).

Green turtle nesting abundance and timing fluctuates significantly from year to year depending on environmental variables, locality and food availability (Pendoley Environmental 2011). Nesting of green turtles has been recorded from August to March on Serrurier Island (Woodside 2002), from December to March along coast adjacent to Ningaloo (CALM 2005a) and from October to February on Varanus Island (Pendoley Environmental 2011). On Barrow Island, mating aggregations may commence from October with peak nesting from December to January, with hatchlings emerging through summer and early autumn. However, nesting on Barrow Island has been recorded all year round (Chevron 2005 and 2008, Pendoley 2005). Nesting on the Scott Reef-Sandy Islet and Browse Island has been observed all year round with peaks between December and January (Commonwealth of Australia 2017a).

The re-nesting period for female green turtles is approximately five years (Hamann et al. 2002).

Green turtles spend the first five to ten years of their life drifting on ocean currents, before moving to reside in shallower benthic habitats, including tropical coral and rocky reefs and seagrass beds. Green turtles have been known to migrate more than 2,600 km between feeding and breeding grounds (Limpus 2008a).

Green turtles are omnivores, mainly feeding in shallow benthic habitats on seagrass and/ or algae, but are also known to feed on sponges, jellyfish and mangroves (Limpus 2008a). Green turtles are unlikely to forage or dwell within deeper offshore waters due to the water depths; however, they may occasionally migrate through it with 86 % of post-nesting turtles being found to migrate to neritic foraging grounds and 14 % having local residency to their rookery in Western Australia (Ferriera et al., 2020).

Ferriera et al. (2020) spatial examination of inter-nesting green turtles found the existing BIA for encompassed the spatial extent, however the BIA is likely largely underestimated for foraging areas.

Figure 8 illustrates the BIAs and habitat critical (draft) for green turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

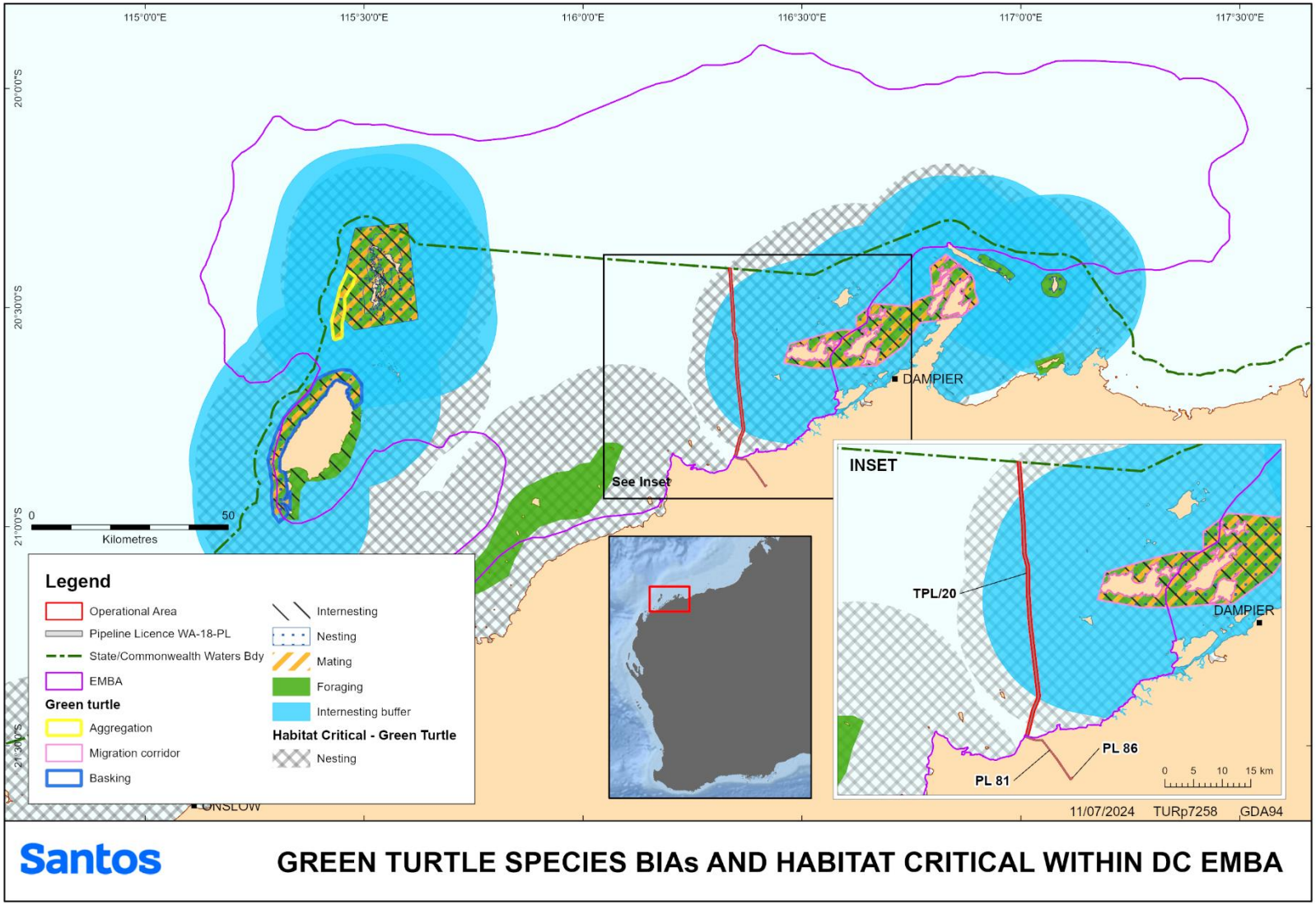


Figure 8: Biologically Important Areas and Habitat Critical – Green Turtle

7.1.3. Hawksbill Turtle

Hawksbill turtles (*Eretmochelys imbricata*) have a global distribution throughout tropical and sub-tropical marine waters. The Western Australian stock is concentrated on the North West Shelf (Dampier Archipelago) (Limpus 2009a) and is considered to be one of the largest hawksbill populations remaining in the world. The estimated number of nesting hawksbill turtles in WA waters is between 2,000 and 4,500 individuals (Morris 2004). There is a second major population of Hawksbill turtles in Australia, which is genetically isolated from the North West Shelf population located along the Northern Territory coast and north-eastern Queensland (Northern Territory Government, n.d).

In WA, their nesting range is relatively small and extends from the Muiron Islands to the Dampier Archipelago, a distance of approximately 400 km. The most significant breeding areas, that support hundreds of nesting females annually, are around sandy beaches within the Dampier Archipelago, Montebello Islands, Lowendal Islands and Barrow Island (Pendoley 2005, Limpus, 2009a).

The largest known nesting area for the North West Shelf population is the sandy shoreline of Rosemary Island, within the Dampier Archipelago, particularly on the north-western side of the Island. It is believed that the Rosemary Island rookery may support up to 1,000 nesting females annually (Limpus 2009). Low density nesting is also known from Barrow Island, Airlie Island, Muiron Islands and North West Cape/ Ningaloo coast (Cape Range) (Limpus 2009a). Nesting hawksbills have also been found on NE Regnard Island and SW Regnard Island, confirming the Regnard Islands as hawksbill rookeries (Pendoley Environmental 2009).

The hawksbill turtle nesting population within the Exmouth region is also considered important as the populations in Western Australia represent the largest remaining population in the Indian Ocean (CALM 2005). The best estimate of numbers within the Ningaloo Marine Park and Muiron Islands Marine Management Area is between 20–700 individuals (Waayers 2010).

A snapshot survey of Varanus Island and the Lowendal Islands conducted for Santos during October 2012 found the five most frequented beaches by hawksbills, based on the track counts, were Beacon Island *(n*=43), Parakeelya (*n*=41), Kaia (*n*=40), Rose (*n*=30) and Pipeline (*n*=28). Results of the October 2012 three-day track census program showed that Beacon Island also hosted the highest daily number of overnight emergences by hawksbills and is therefore an important nesting beach for hawksbill turtles (Pendoley Environmental 2013).

On Varanus Island, hawksbill turtle nesting activity is predominantly distributed on the island's east coast, including Pipeline, Harriet, and Andersons beaches (Pendoley Environmental 2019). Individual hawksbill turtles appear to show a strong fidelity to these beaches, often returning to the same beach to nest within the season (Pendoley Environmental 2019). Between 1986 and 2019, a total of 571 individual hawksbill turtles were tagged on Varanus Island. Recent baseline data was collected at the Montebello and Dampier AMPs by Keesing, 2019 showing that only one hawksbill turtle was identified during the survey at the Dampier AMP only. No marine turtle species were identified during the survey at Montebello AMP.

Nesting is reported to occur between October and February in WA (Commonwealth of Australia 2017a). Hawksbill turtles have been observed breeding on the North West Shelf between July and March with peak nesting activity around the Lowendal Islands between October and December (Limpus 2009a).

Female hawksbills skip annual breeding opportunities (Kendall & Bjorkland 2001), presumably due to high energy demands of breeding (Chaloupka & Prince 2012).

Individuals may migrate up to 2,400 km between their nesting and foraging grounds (DSWEPaC 2012a), however a recent tagging study showed that turtles migrating from WA rookeries remain on the continental shelf (< 200 m depth) and within Australian waters during their inter-nesting, migrating and foraging phases (Fossette et al. 2021). Satellite tracking of nesting turtles on Varanus Island (32 km) and Rosemary Island has shown adult turtles to feed between 50 and 450 km from their nesting beaches (DSWEPaC 2012a).

Adults tend to forage in tropical tidal and sub-tidal coral and rocky reef habitat where they feed on an omnivorous diet of sponges, algae, jelly fish and cephalopods (DSWEPaC 2012a). Hawksbill turtles are unlikely to spend significant time within offshore waters as it is too deep to act as a feeding ground. However, it is likely they may migrate through those areas.

In order to better quantify and map the important areas used by Hawksbill turtles, AIMS was engaged in 2020 to lead the North West Shoals to Shores Research Program. During this program, AIMS combined available existing satellite tracking data for 20 adult turtles with data from newly deployed satellite tags on 20 adults in the Lowendal Islands and Dampier Archipelago (AIMS, 2021). Results showed that critical habitat designated by the Australian Government for inter-nesting largely protects the nesting areas calculated (AIMS, 2021), however the existing foraging BIAs do not include the majority of foraging areas calculated (AIMS, 2021). While approximately 23% of the hawksbill turtles foraging distribution occurred within MPAs, the existing BIAs are largely underestimating the important foraging areas for the turtles (AIMS, 2021). This supports the results of a joint study conducted by Fossette et al. (Fossette et al. 2021), which found only 10% of foraging areas utilised by 42 nesting turtles

(between 2000 and 2017) were encompassed by the designated foraging BIA. Fossette et al. (2021) found that the highest overlap of individual turtles occurred within the Migratory BIA corridor.

Figure 9 illustrates the BIAs and habitat critical (draft) for hawksbill and olive ridley turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

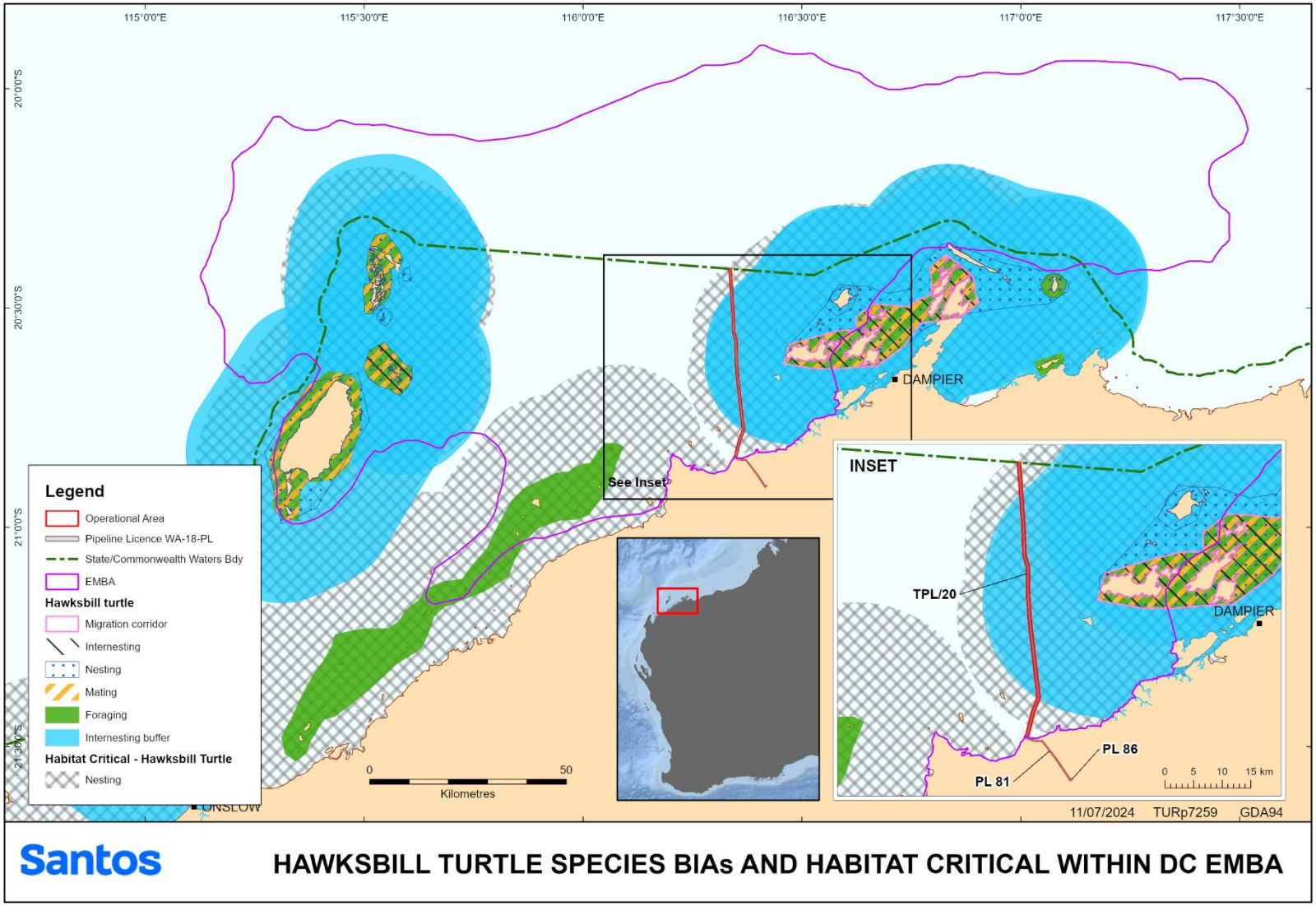


Figure 9: Biologically Important Areas and Habitat Critical – Hawksbill Turtle

7.1.4. Flatback Turtle

The flatback turtle (*Natator depressus*) has an Australasian distribution, with all recorded nesting beaches occurring within tropical to sub-tropical Australian waters. One third of the total breeding for the species occurs in Western Australia (WA) (Limpus, 2007). The management of the flatback turtle in Australia is broken up into five stocks currently described around Australia; eastern Queensland, Arafura Sea, Cape Domett, South-west Kimberley and Pilbara stocks (Commonwealth of Australia 2017). The Pilbara stock nests throughout the North West Shelf and is characterised by summer nesting (October to March), and the northern stock at Cape Domett breeds mainly in winter (July to September) (Commonwealth of Australia 2017a). The South-west Kimberley stock is also characterised by summer nesting. Populations in western NT are thought to nest all year round with nesting density reaching its peak in July. Populations in northern Australia also nest all year round, with nesting density reaching its peak between June and August (Limpus, 2007).

The southern WA nesting population of flatback turtles occurs from Exmouth to the Lacepede Islands off the Kimberley coast (DSEWPaC 2012c). On the North West Shelf, significant rookeries are centred on Barrow Island especially the east coast beaches (DSEWPaC 2012b).

Montebello Islands, Thevenard Island, Varanus Island, the Lowendal Islands, King Sound and Dampier Archipelago are also significant rookeries (Pendoley 2005, Limpus 2007, Pendoley Environmental 2011). Nesting is also widespread along the mainland beaches from Mundabullangana on the Pilbara coast north, including Cemetery Beach near Port Hedland, Eighty Mile Beach and to Broome (Limpus 2007, DSEWPaC 2012b).

Long term monitoring of flatback turtles nesting in the Port Hedland area, specifically at Cemetery Beach and Pretty Pool Beach, was undertaken between 2004 and 2014. Monitoring results indicated the main nesting season of flatback turtles in the area was between mid-October and January, which is consistent with other rookeries in the Pilbara region including Barrow Island, Mundabullangana, Karratha and Onslow (Waayers and Stubbs 2016). The onset of the nesting season appears to be relatively consistent each year and is thought to be associated with the southern movement of warmer sea surface temperatures along the northern WA coast.

There have been occasional records of nesting by flatback turtles on the Jurabi Coast and Muiron Islands (CALM 2005). During turtle surveys for Santos, WA flatback turtle nesting was recorded on Bessieres Islands (Astron 2014), Serrurier, Flat, Table and Round Island in previous surveys (Pendoley Environmental 2009). Flatback turtle tracks have been seen on Forty Mile beach and evidence of flatback nesting was recorded on the same beach the next day (Pendoley Environmental 2009). Previously the status of the flatback population(s) was undetermined and although not well quantified, it was estimated to be many thousands of females (Limpus 2007). However, Pendoley et al. (2014a, b) reported both Barrow Island and Mundabullangana flatback turtles as substantial reproductive populations with estimates of 1,512 and 1,461 nesting females annually respectively. Thevenard Island and Port Hedland were also identified as rookeries, but turtle nesting numbers are not known.

Satellite tracking of adult (female) flatback turtles shows they use a variety of inshore and offshore marine areas off the east and west coasts of Barrow Island. Females inter-nest close to their nesting beaches, typically in 0–10 m of water (Chevron 2008). However, flatback turtles also travel approximately 70 km and inter-nest in shallow nearshore water off the adjacent mainland coast, before returning to Barrow Island to lay another clutch of eggs. The average inter-nesting period is 13–16 days.

From long-term tagging studies on Varanus Island and Pendoley's observations, it appears that the nesting season for flatback turtles peaks in December and January with subsequent peak hatchling emergence in February and March. Flatbacks have been observed to nest on Varanus Island between November and February (Chevron 2008, Pendoley Environmental 2011 & 2013). Population monitoring of flatback turtles on Varanus Island, calculated from 16 seasons, indicates a mean population estimate of 226 (+/- 97). Modelled flatback turtle populations have shown a slight decline from 2008/09 to 2016/17, which is considered to be part of fluctuations in the natural cycle (Astron 2017). Flatback turtles tend to nest on all beaches on Varanus Island (Astron 2017). Flatback hatching and emergence success is noted as higher compared to that reported for other Western Australian rookeries (Pendoley et al. 2014; cited Astron 2017).

Unlike other sea turtles, the flatback turtle lacks a wide oceanic dispersal phase and adults tend to be found in soft sediment habitats within the continental shelf of northern Australia (DSEWPaC 2012b). Despite having geographically large foraging ranges (>1500 km), genetic differentiation suggests strong natal homing for both males and females (Turner Tomaszewicz et al., 2022). Little information is known on the diets of flatback turtles (DSEWPaC 2012b); however, they are believed to forage on primarily soft-bodied invertebrates (Commonwealth of Australia 2017a). Flatback turtles also differ from other species of sea turtles in maturing at a larger size and a likely younger age (<20 years) in comparison to other sea turtle species, indicating they may have a more rapid growth rate in their juvenile (similar to the leatherback turtle, a species with their own family) (Turner Tomaszewicz et al., 2022). This information from Turner Tomaszewicz et al., 2022 may provide valuable insight for ongoing population assessments and future recovery plans (Turner Tomaszewicz et al., 2022).

Figure 10 illustrates the BIAs and habitat critical (draft) for flatback turtles (as defined in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a).

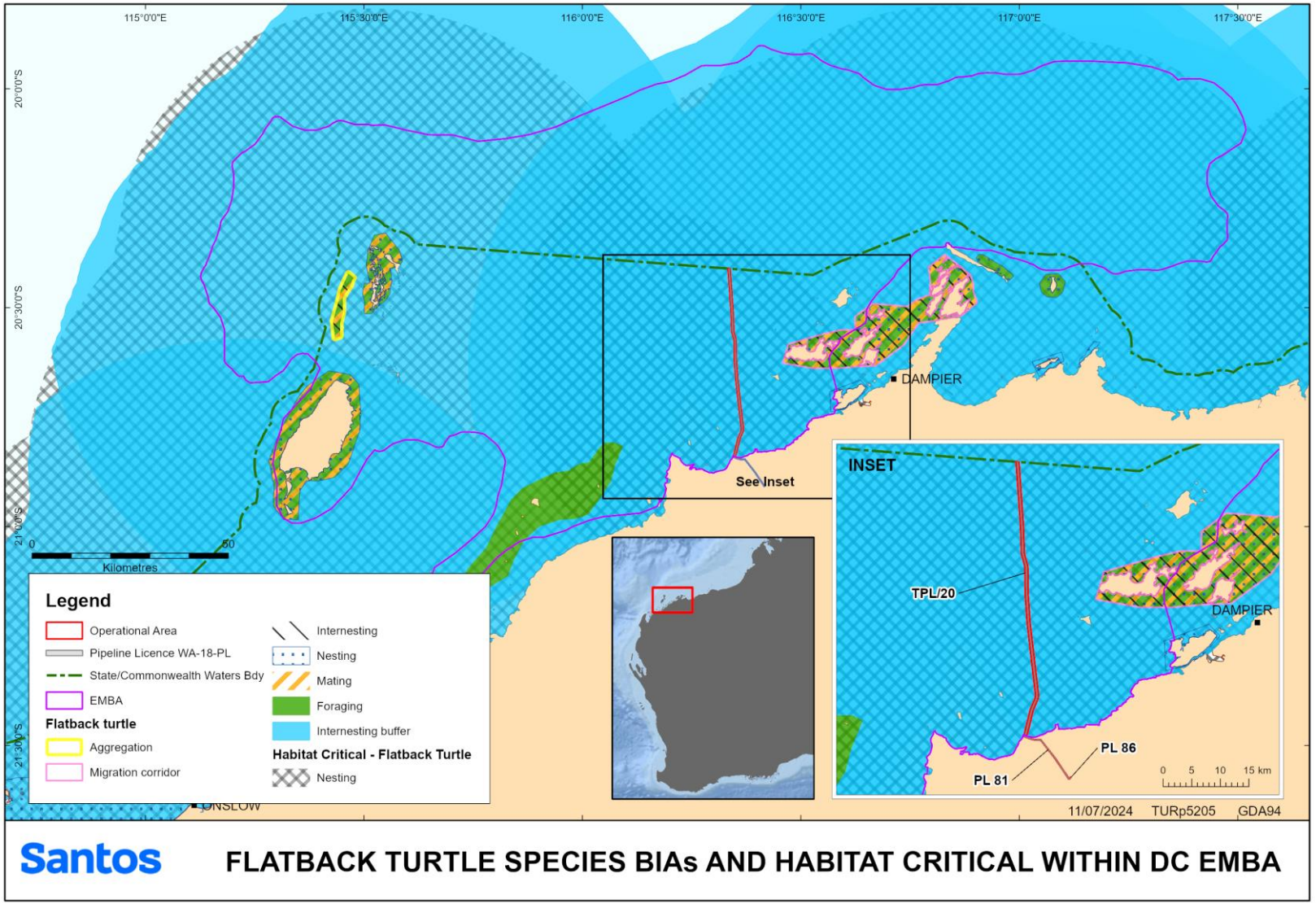


Figure 10: Biologically Important Areas and Habitat Critical – Flatback Turtle

7.1.5. Leatherback Turtle

The leatherback turtle *(*Dermochelys coriacea) has the widest distribution of any marine turtle and can be found from tropical to temperate waters throughout the world (Márquez 1990). There are no major leatherback turtle centres of nesting activity that have been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the Northern Territory (Limpus and McLachlin 1994).

There have been several records of leatherback turtles off the coast of WA, but no confirmed nesting sites (Limpus 2009c). Turtle observations have mainly occurred south of the North West Shelf area and in open waters (>200 m deep) (Limpus 2009c). Due to the lack of nesting sites around Australian coastal waters, it is presumed that leatherback turtles observed in Australian waters are migrating from neighbouring countries to utilise feeding grounds in Australia (Limpus 2009c).

The leatherback turtle will feed at all levels of the water column and is carnivorous feeding mainly on pelagic, soft-bodied marine organisms such as jellyfish, which occur in greatest concentrations in areas of upwelling or convergence (DSEWPaC 2012d). The leatherback turtle is a highly pelagic species with adults only going ashore to breed.

A BIA for this endangered species was identified in the vicinity of Danger Point, Cobourg Peninsula. The nesting is unconfirmed at present (DSEWPaC 2012b, Commonwealth of Australia 2017a).

7.2. Seasnakes

Storr et al. (1986) estimate nine genera and 22 species of sea snakes occur in WA waters, with 25 listed marine seasnake species being recorded in the search area of WA (Appendix D of the DC Gas Supply Pipeline EP). Little is known of the distribution of individual species, population sizes or aspects of their ecology. Seasnakes are essentially tropical in distribution, and habitats reflect influences of factors such as water depth, nature of seabed, turbidity and season (Heatwole and Cogger 1993). Seasnakes are widespread throughout waters of the North West Shelf in offshore and nearshore habitats. They can be highly mobile and cover large distances or they may be restricted to relatively shallow waters and some species must return to land to eat and rest. In the north-west region of Western Australia, no BIAs have been designated for seasnakes.

Two species of seasnakes listed as threatened under the EPBC Act were identified in the Protected Matters search within the EMBA (Appendix D of the DC Gas Supply Pipeline EP):

- Short-nosed seasnake (*Aipysurus apraefrontalis*)
- Leaf-scaled seasnake (*Aipysurus foliosquama*).

7.2.1. Short-nosed Seasnake

The short-nosed seasnake (*Aipysurus apraefrontalis*) is listed as critically endangered under the EPBC Act and the BC Act. It is a fully aquatic, small snake and is endemic to WA. It has been recorded from Exmouth Gulf, WA to the reefs of the Sahul Shelf, in the eastern Indian Ocean. This species is believed to show strong site fidelity to shallow coral reef habitats in less than 10 m of water, with most specimens having been collected from Ashmore and Hibernia reefs (Minton & Heatwole 1975, Guinea and Whiting 2005).

The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m (McCosker 1975, Cogger 2000). The species has been observed during daylight hours, resting beneath small coral overhangs or coral heads in 1–2 m of water (McCosker 1975). Guinea and Whiting (2005) reported that very few short-nosed seasnakes moved even as far as 50 m away from the reef flat and are therefore unlikely to be expected in high numbers in offshore, deeper waters.

7.2.2. Leaf-scaled Seasnake

The leaf-scaled seasnake *(Aipysurus foliosquama)* is listed as critically endangered under the EPBC Act and the BC Act. It occurs in shallow water (less than 10 m in depth), in the protected parts of the reef flat, adjacent to living coral and on coral substrates (DoE 2014). The species is found only on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia Reefs (outside the EMBA) (Minton and Heatwole 1975). The leaf-scaled seasnake forages by searching in fish burrows on the reef flat (DoE 2014).

7.3. Biologically Important Areas/Habitat Critical – Marine Reptiles

Table 6 provides an overview of BIAs in the EMBA for marine reptiles, as identified by the DAWE (Commonwealth) and critical habitats identified in associated recovery plans. The DAWE may make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in **Section 15.2**.In

addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of habitat critical - habitat ‘critical to the survival of the threatened species. To date no habitat critical in WA has been listed under either Act. No provision is made under the TPWC Act for listing critical habitat.

Table 6: Biologically Important Areas/Habitat Critical and geographic locations - reptiles

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
Loggerhead turtle	*Caretta caretta*	Internesting buffer and nesting – islands and coastline of the Kimberley region and islands of the North West Shelf, Ningaloo coast and Jurabi coast	Lowenthal Island Montebello Island Muiron Island Rosemary Island	Exmouth and Ningaloo coast. 20 km internesting buffer
Green turtle	*Chelonia mydas*	Nesting, migration foraging, aggregation, mating, migration corridor, critical habitat, basking, internesting and interesting buffer – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/nesting – Dampier Archipelago Basking – Middle Island	Barrow Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) Greens - inshore tidal and shallow subtidal areas around Barrow Island Hawksbills - shallow water coral reef and artificial reef (pipeline) habitat Middle Is. West Coast Barrow Island West Coast and North Coast Montebello Island - Hermite Island, NW Island, Trimouille Island Montebello Islands North and South Muiron Island String of islands between Cape Preston and Onslow, inshore of Barrow Island	Dampier Archipelago. 20 km internesting buffer Barrow Island, Montebello Islands, Serrier Island and Thevenard Island. 20 km internesting buffer Exmouth Gulf and Ningaloo coast. 20 km internesting buffer
Hawksbill turtle	*Eretmochelys imbricata*	Nesting, migration, mating, migration corridor, critical habitat, foraging, internesting and interesting buffer – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/ nesting/ internesting – Lowendal group, Montebello Islands	Barrow Island Dampier Archipelago (islands to the west of the Burrup Peninsula) Delambre Island (and other Dampier Archipelago Islands) Greens - inshore tidal and shallow subtidal areas around Barrow Island Hawksbills - shallow water coral reef and artificial reef (pipeline) habitat Lowendal Island Group Montebello Island - Hermite Island, NW Island, Trimouille Island Montebello Island, Trimoulle and NW islands Rosemary Island	Cape Preston to mouth of Exmouth Gulf (including Montebello Islands and Lowendal Islands). 20 km internesting buffer Dampier Archipelago (including Delambre Island and Rosemary Island). 20 km internesting buffer

Species	Scientific name	Aggregation area and use	BIAs within EMBA	Habitat Critical within EMBA
			String of islands between Cape Preston and Onslow, inshore of Barrow Island Varanus Island	
Flatback turtle	*Natator depressus*	Nesting, foraging, migration corridor, aggregation, critical habitat, internesting and internesting buffer – Islands of the North West Shelf and the Pilbara/ Kimberley coastlines Mating, nesting – Barrow Island	Barrow Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) Montebello Island - Hermite Island, NW Island, Trimouille Island String of islands between Cape Preston and Onslow, inshore of Barrow Is	Dampier Archipelago, including Delambre Island and Hauy Island. 60 km internesting buffer Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island. 60 km internesting buffer Soldier Point to Pirlangimpi including Seafull Island. 60 km internesting buffer Brace point to One Tree Point, including all offshore islands. 60 km internesting buffer
Leatherback turtle	*Dermochelys coriacea*	None within EMBA	-	-

8. Marine Mammals

Eleven species of listed marine mammals are known to occur in the EMBA, according to the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP). An examination of the species profile and threats database (DAWE 2024) showed that some listed mammal species are not expected to occur in significant numbers in the marine and coastal environments in the EMBA due to their terrestrial distributions. Hence, these species are not discussed further.

Of the listed species, four are listed as threatened and migratory and seven are listed as migratory under the Commonwealth EPBC Act (BIAs for marine mammals are discussed in **Table 9**. These species are shown in **Table 7** along with their conservation listing under the WA BC Act and TPWC Act (as applicable).

The section below gives further details on marine mammal species listed as threatened and migratory and a summary is presented in **Table 8**. Identified BIAs are presented in **Table 9**.

Table 7: Marine mammals listed as threatened or migratory under the EPBC Act

Species	Conservation Status				Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
Sei whale (*Balaenoptera borealis*)	Vulnerable Migratory	Endangered	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Pygmy blue whale (*Balaenoptera musculus*)	Endangered Migratory	Endangered	-	-	Distribution and migration route known to occur within area	Yes – Refer to **Table 9**
Fin whale (*Balaenoptera physalus*)	Vulnerable Migratory	Endangered	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Southern right whale (*Eubalaena australis*)	Endangered Migratory	Vulnerable	-	-	Species or species habitat may occur within area	None - No BIA defined
Humpback whale (*Megaptera novaeangliae*)	Migratory	Special conservation interest and Migratory	-	Listed nationally	Migration (north and south) known to occur within area	Yes – Refer to **Table 9**
Bryde's whale (*Balaenoptera edeni*)	Migratory	Migratory	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Killer whale (*Orcinus orca*)	Migratory	Migratory	-	-	Species or species habitat may occur within area	None - No BIA defined
Australian Humpback Dolphin (*Sousa sahulensis*)	Migratory (as *Sousa chinensis*)	Migratory	Priority 4	-	Species or species habitat known to occur within area	None – BIA not found in EMBA
Spotted bottlenose dolphin (Arafura/Timor Sea populations) (*Tursiops aduncus*)	Migratory	Migratory	-	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
Irrawaddy dolphin (Australian snubfin dolphin) (*Orcaella heinsohni*)	Migratory	Migratory	Priority 4	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA
Dugong (*Dugong dugon*)	Migratory	Migratory	-	-	Species or species habitat known to occur within area	None - BIA not found in EMBA

8.1. Threatened and Migratory Species

8.1.1. Sei Whale

Sei whales have a worldwide, oceanic distribution and migrate between low-latitude tropical and subtropical regions during the winter and temperate and subpolar latitudes in summer (Leaper et al. 2008). Sei whales tend to be found further offshore than other species of large whales (Bannister et al. 1996).

Sei whales move between Australian waters and Antarctic feeding areas; however, they are only infrequently recorded in Australian waters (Bannister et al. 1996) and their movements and distribution in Australian waters is not well known (DAWE 2020a). There are no known mating or calving areas in Australian waters (Parker 1978 in DAWE 2020a). The National Conservation Values Atlas currently record no BIAs for this species (DAWE 2020b). Surveys of the Bonney Upwelling (outside of the EMBA) between 2000 and 2003 recorded sightings of sei whales feeding during summer and autumn, indicating that this is potentially an important feeding ground (DAWE 2020b).

8.1.2. Blue Whale

Two sub-species of blue whale are recorded in Australian waters: the southern (or true) blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*). Southern blue whales are believed to occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic) (DEWHA 2008). By this definition all blue whales in waters from Busselton to the NT are assumed to be pygmy blue whales and are discussed below.

Pygmy blue whale populations are distinguishable only acoustically as they do not display morphological differences (Leroy et al. 2021). Prior to 2020 there were believed to be three populations of the pygmy blue whale (B. m. brevicauda), however, evidence for a fourth pygmy blue whale acoustic population were found by Cerchio, S. et al. (2020), and a fifth was identified by Leroy et al. (2021).

Pygmy blue whales have a southern hemisphere distribution, migrating from tropical water breeding grounds in winter to temperate and polar water feeding grounds in summer (Bannister et al. 1996, Double et al. 2014), such as the Perth Canyon and adjacent waters (Rennie et al., 2009) and the Great Southern Australian Coastal Upwelling System (Möller et al., 2020). The WA migration path takes pygmy blue whales down the WA coast to coastal upwelling areas along southern Australia (Gill 2002) and south at least as far as the Antarctic convergence zone (Gedamke et al. 2007).

Tagging surveys have shown pygmy blue whales migrating northward relatively near to the Australian coastline (100 km) until reaching North West Cape after which they travelled offshore (240 km) to Indonesia (Double et al., 2014). Passive acoustic data documented pygmy blue whales migrating along the Western Australian shelf break (Woodside 2012). Tagging data collected by Gales et al. (2010) has provided the first definitive link between the blue whales that feed off the Perth Canyon and those that occur around Indonesia. This is movement is concordant with the proposed ‘Tasmania to Indonesia’ population described by Branch et al. (2007).

The northern migration passes the Perth Canyon from January to May and north bound animals have been detected off Exmouth and the Montebello Islands between April and August (Double et al. 2012a, McCauley & Jenner 2010). A noise monitoring study conducted in 2014-15 recorded pygmy blue whales moving in a northward direction in August 2014 and between late-May to early July 2015 (JASCO Applied Sciences, 2016; McPherson et al., 2015). During the southern migration, pygmy blue whales pass south of the Montebello Islands and Exmouth from October to the end of January, peaking in late November to early December (Double et al. 2012b). No detections of the species were made during the period of their southward migration during the noise monitoring study.

Generally, they appear to travel as individuals or in small groups based on acoustic data. For example, analysis of pygmy blue whale calls from noise loggers deployed around Scott Reef (2006 to 2009) for the Woodside Browse project showed that 78% of the calls were from lone whales, 18% were from two whales and 4% were from three or more whales (McCauley 2011; Woodside 2014).

Pygmy blue whales appear to feed regularly along their migration route (i.e. at least once per week or more frequently) and are likely to have multiple food caches along their migratory route (e.g. Rowley Shoals and Ningaloo Reef) (ConocoPhillips 2018).

Recognised feeding areas of significance to this species, located within the EMBA include Ningaloo Reef (DoE 2015a). The Ningaloo Reef area has the capacity to offer feeding opportunities to pygmy blue whales through unique biophysical conditions able to support large biomasses of marine species (Double et al. 2014).

Surface lunge feeding of pygmy blue whales has been observed at North West Cape and Ningaloo Reef in June (C. Jenner & M-N Jenner, unpublished data, 2001 in Double et al. 2014). Outside of the recognised feeding areas,

possible foraging areas for pygmy blue whales include the greater region around the Perth Canyon, off Exmouth and Scott Reef in WA (DoE 2015). These steep gradient features tend to stimulate upwelling and, therefore increased productivity (seasonally variable) (ConocoPhillips 2018). Hence, they provide a favourable foraging area.

Breeding areas have not yet been identified; however, it is likely that pygmy blue whales calve in tropical areas of high localised production such as deep offshore waters of the Banda and Molucca Seas in Indonesia (Double et al. 2014, DAWE 2020a). There are no known breeding areas of significance to blue whales in waters from Busselton to the NT.

The BIAs for blue whale and pygmy blue whale are detailed in **Table 9** and depicted in **Figure 11**. However, a recent study by Thums et al. (2022) used a combination of passive acoustic monitoring of the Northwest Australian coast (46 instruments from 2006 to 2019) and satellite telemetry data (22 tag deployments from 2009 to 2021) to model the spatial extent of pygmy blue whale high use areas for foraging and migration and compared these areas to the BIAs. The synthesis of data indicated that pygmy blue whales extensively use the continental slope habitat rather than the continental shelf habitat off Western Australian coast compared to southern Australia.

Thums et al. (2022) described three important foraging (and/or resting/breeding) areas, including; The Perth Canyon and vicinity, the shelf edge off Geraldton and; the shelf edge from Ningaloo Reef to the Rowley Shoals (not continuous).The study found that the Foraging BIA off the south-west of Western Australia encompassed 83 % of the most important areas in that region, however; the ‘Annual High Use Foraging’ BIA within that BIA only encompassed 7 % of the most important area.

The most significant overlaps were seen with the Migration BIAs, whereby the most important migration area had an 82 % overlap with the part of the Migration BIA that occurs in Australia. Thums et al. (2022) also stated that the available data indicated that the East Indian Ocean pygmy blue whales spent up to 124 days in Indonesian and Timorese waters (34 % of annual cycle) and this area may also be the calving ground for this population.

The Australian Government may now have to consider this quantitative assessment of important areas in future reviews of the BIAs (Thums et al. 2022).

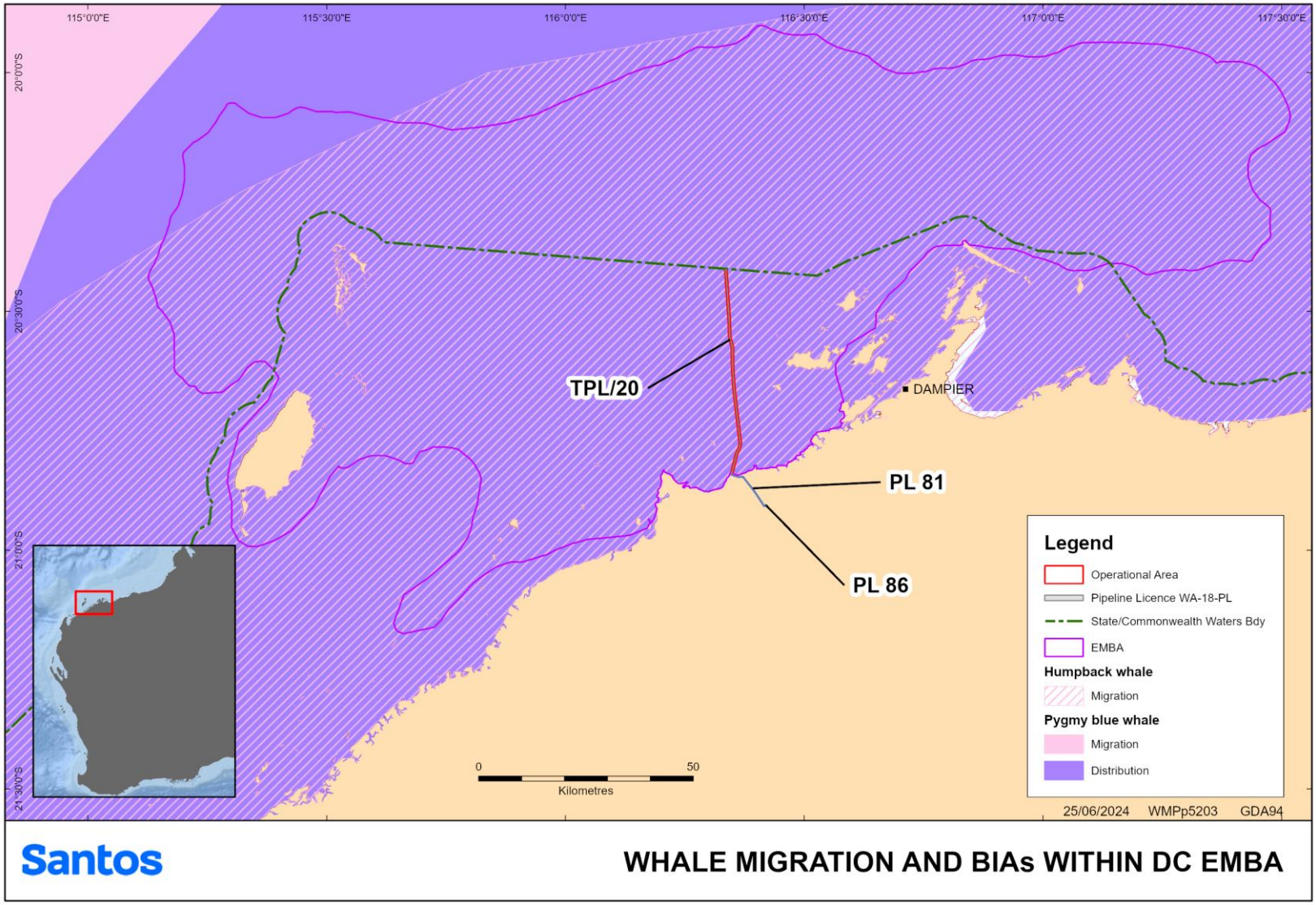


Figure 11: Biologically Important Areas for whales in the DC EMBA

8.1.3. Fin Whale

Fin whales have a worldwide distribution generally in deeper waters, with oceanic migrations between warm water breeding grounds and cold-water feeding grounds.

The fin whale distribution in Australia is not clear due to the sparsity of sightings. Information is known primarily from stranding events and whaling records. According to the Species Profile and Threats database (DAWE 2020a); fin whales are thought to be present from Exmouth, along the southern coastline, to southern Queensland.

Migration paths are uncertain but are not thought to follow Australian coastlines (Bannister et al. 1996). There is insufficient data to prescribe migration times for fin whales.

There are no known mating or calving areas in Australian waters (DoEE 2019a) and no BIAs for the fin whale are currently identified by the National Conservation Values Atlas (DAWE 2020b).

8.1.4. Southern Right Whale

The southern right whale is present in the southern hemisphere between approximately 30° and 60°S. The species feeds in the Southern Ocean in summer, moving close to shore in winter.

In Australian waters, southern right whales range from Perth, along the southern coastline, to Sydney. Sightings have been recorded as far north as Exmouth although these are rare (Bannister et al. 1996).

BIAs including calving aggregation and migration areas are recorded for this species within the EMBA. Migration occurs along the WA coastline between April and October, with a couple of emerging aggregation areas at Flinders Bay and Hassell Beach (DSEWPaC 2012). Calving occurs within the Exmouth Gulf region (DAWE 2020)..

8.1.5. Humpback Whale

Humpback whales have a worldwide distribution, migrating along coastal waters from polar feeding grounds to subtropical breeding grounds. Geographic populations are distinct and at least six southern hemisphere populations are thought to exist based on Antarctic feeding distribution and the location of breeding grounds on either side of each continent (Bannister et al. 1996). The largest known population of humpback whales breeds along the coast of Western Australia (Branch, 2011, Salgado Kent et al., 2012, IWC, 2014) and has a recognised resting ground in the Exmouth Gulf (Irvine & Kent 2018). The population of humpback whales migrating along the WA coastline was recently estimated to be greater than 33,000 whales and likely increasing at exceptionally high growth rates between 10–12 % (Hedley et al. 2011, Salgado Kent et al. 2012).

Humpback whale populations have increased since being placed on the threatened species list for exploitation from whaling, resulting in a higher abundance of species off our Western Australian coastline. Effective from 26/02/2022, Humpback whales are no longer classed as vulnerable under the EPBC Act, however; they remain a Matter of National Environmental Significance as a listed Migratory Species and Cetacean under EPBC Act Division 3, where it is an offence to kill, injure, take, trade, keep, move or interfere with a cetacean. Humpback whales have been able to thrive and increase in numbers despite the heavy oil and gas exploration. A study presented by Bejder et al. (2016) has prompted a review of the species being down listed under Commonwealth legislation and regulations, as they are not eligible for listing as a threatened species under all statutory criteria. The west coast Australian humpback whale population migrates from Southern Polar Ocean ‘summer’ feeding grounds to their northern tropical ‘winter’ calving/ breeding grounds in coastal waters of the Kimberley. The northern migration tends to follow deeper waters of the continental shelf, whilst the southward migration concentrates whales closer to the mainland (Jenner et al. 2001; Irvine et al., 2018). Recent satellite tagging of southbound humpback whales indicate that whales generally migrated close to the coastline, within a few tens of kilometres of shore and in a corridor frequently less than 100 km (Double et al. 2010). Aerial surveys and noise logger recordings undertaken for Chevron’s Wheatstone Project indicated that the main distribution of humpback whales was sighted at an average distance of 50 km from the mainland during the northern migration and 35 km during the southbound migration (RPS 2010a). Woodside have conducted aerial surveys that have confirmed that the reported distribution of migrating humpback whales off the North West Cape is consistent with baseline surveys first conducted in 2000 to 2001 (RPS, 2010 in Woodside 2020).

The precise timing of the migration varies between years by up to six weeks, influenced by water temperature, sea ice distribution, predation risk, prey abundance and the location of feeding grounds (DEWR 2007).

Peak northward migration across the North West Shelf is identified as from late July to early August, and peak southward migration from late August to early September (DoEE 2015c). Data collected between 1995 and 1997 by the Centre for Whale Research indicates that the period for peak northern migration into the calving grounds in the Kimberley is mid to late July. The peak for southern migration is in the first half of September (Jenner et al.

2001). Actual timing of annual migration may vary by as much as three weeks from year to year due to food availability in the Antarctic (DMP 2003).

Satellite tagging data collected for migrating northbound humpback whales identified a consistent narrow inshore distribution, unlike the southward migration. There was little evidence that the whales tended to venture further from shore and into deeper water at any point on their northward migration. Whales were seen with calves off the North West Cape outside the 'calving grounds; of Lacepede Islands to Camden Sound. This indicates some potential for this area being used as a 'calving site' as well as a migratory corridor. Consequently, the region from the Lacepede Islands to Camden Sound should not be seen as the exclusive 'calving ground' for this population (Double et al. 2012b).

Details on the BIA for humpback whales are provided in **Table 9** and depicted in

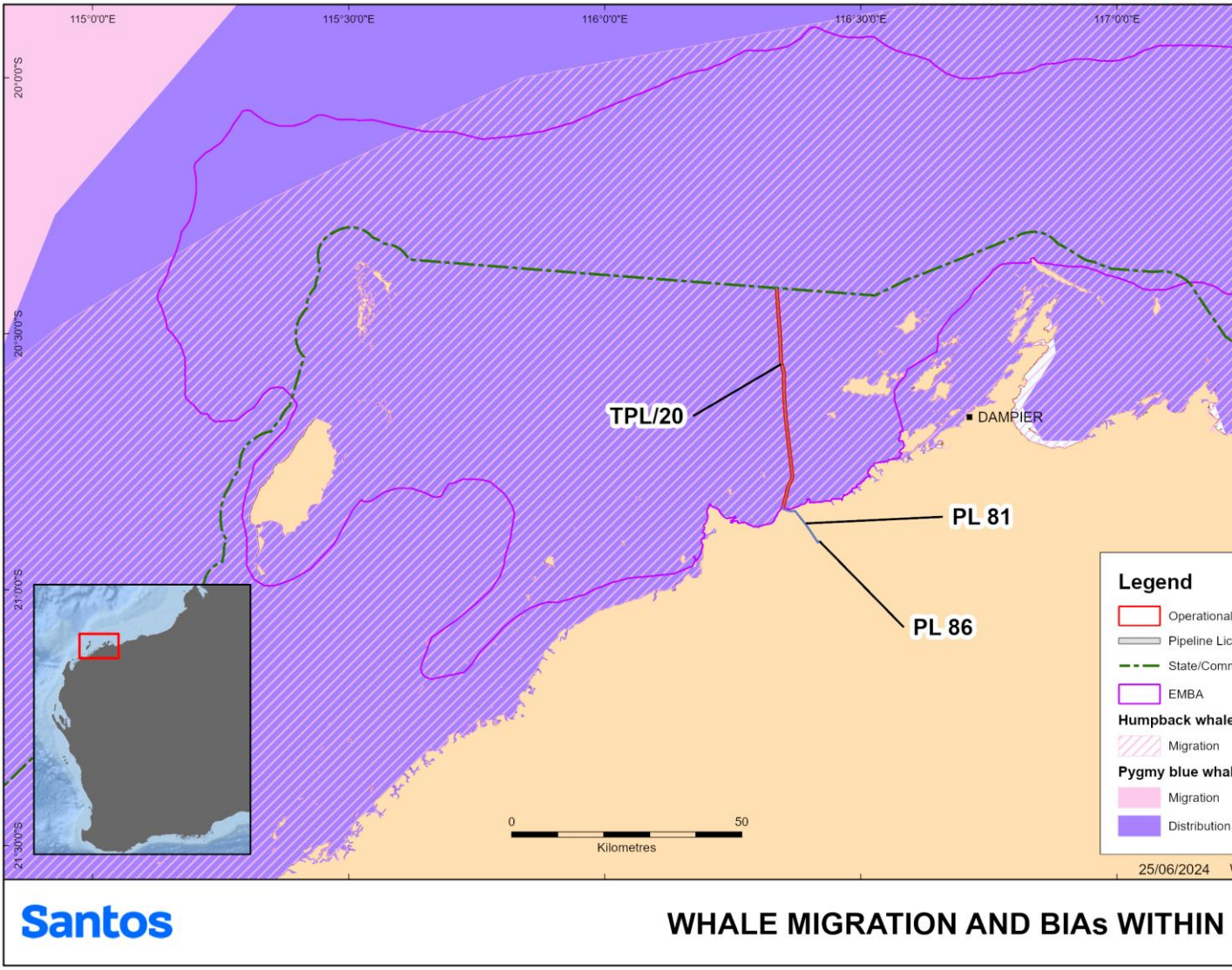


Figure 11.

8.1.6. Bryde's Whale

Bryde's whales (*Balaenoptera edeni;* Migratory) are distributed year-round across tropical and warm temperate waters with individuals recorded in all Australian states, except the NT (Ceccarelli et al., 2011; Kato 2002). The species typically moves between 40 °N and 40 °S, with these movements seeming to be primarily linked to prey availability (DoE, 2023k). Two forms are recognised: inshore and offshore Bryde's whales. It appears that the inshore form is restricted to the 200 m depth isobar whilst the offshore form is found in deeper waters of 500-1,000 m (DoEE 2019c). Both forms are expected to be found in zones of upwelling where they feed on shrimp like crustaceans (Bannister et al. 1996). Little is known about the population abundance of Bryde's whale, the location

of exact breeding and calving grounds and large-scale migration patterns (DoEE 2019c). It is however, suggested that the offshore form migrates seasonally, heading towards warmer tropical waters during the winter.

8.1.7. Killer Whale

The killer whale has a widespread global distribution and has been recorded in waters of all Australian states/territories (Bannister et al. 1996). Whilst more commonly found in cold, deeper waters, killer whales have been observed along the continental slope, shelf and shallower coastal areas. Killer whales are known to make seasonal movements and are most likely to follow the migratory routes of their prey, however, little is known about these movements (DoEE, 2019). They are more likely to be observed around seal colonies, with a significant seal colony within the EMBA being located in WA at the Abrolhos Islands.

8.1.8. Australian Humpback Dolphin

Australian humpback dolphins (*Sousa sahulensis*) are found in tropical/subtropical waters of the Sahul Shelf from northern Australia to the southern waters of the island of New Guinea (Jefferson and Rosenbaum, 2014). In Australia, humpback dolphins are thought to be widely distributed along the northern Australian coastline from approximately the Queensland–New South Wales border to western Shark Bay, Western Australia (Parra & Cagnazzi 2016). Most studies to date indicate that Australian humpback dolphins occur mostly close to the coast (within 20 km from land) and in relatively sheltered offshore waters near reefs or islands (Parra & Cagnazzi 2016). Around the North West Cape, dolphins have been sighted in clear waters over Ningaloo Reef, and in turbid waters in Exmouth Gulf and in depths ranging from 1 to 40 m deep. Australian humpback dolphins do not appear to undergo large-scale seasonal migrations, although seasonal shifts in abundance have been observed.

8.1.9. Spotted Bottlenose Dolphin (Indo-Pacific bottlenose dolphin)

The spotted bottlenose dolphin (*Tursiops aduncus*) (Arafura/ Timor Sea populations) is generally considered to be a warm water subspecies of the spotted bottlenose dolphin, occurring in shallow (often <10 m deep) inshore waters (Bannister et al., 1996; Hale et al., 2000). The known distribution of the spotted bottlenose dolphin extends from Shark Bay north to the western edge of the Gulf of Carpentaria in Australia (DoEE 2016b).

8.1.10. Irrawaddy Dolphin (Australian Snubfin Dolphin)

The Irrawaddy dolphin, also known as the snubfin dolphin (*Orcaella heinsohni*) is known to occur within the waters off northern Australia, extending north from Broome in Western Australia to the Brisbane River in Queensland (DoEE 2016c). Surveys have indicated that the species is typically found in protected shallow nearshore waters, generally less than 20 m deep, adjacent to river and creek mouths close to seagrass beds (DoEE 2016c). The snubfin dolphin was not recorded during any of the aerial surveys undertaken along the Dampier Peninsula coastline in the vicinity of James Price Point but were observed in Roebuck Bay from vessels on several occasions (RPS, 2010b). Based on the extensive survey effort and amenable conditions within the James Price Point coastal area during the survey, it is concluded that this species is seldom found outside of shallow and sheltered bays and inlets (DSD 2010). 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.

8.1.11. Dugong

The dugong (*Dugong dugon*) is a large herbivorous marine mammal (up to 3 m) that feeds off seagrass and generally inhabits coastal areas. Key populations along the WA coast are principally located at: Shark Bay (the largest resident population in Australia), Ningaloo Marine Park and Exmouth Gulf, the Pilbara coast and offshore areas including Montebello/ Barrow/ Lowendal Islands, and further north at Eighty Mile Beach and off the Kimberley Coast, particularly Roebuck Bay and Dampier Peninsula (Marsh et al. 2002; DSEWPaC 2012). Populations are also present at Ashmore Reef, and the north coast of the Tiwi Islands is recognised as a key site for the conservation of dugongs. A well-known major dugong aggregation of approximately 4,400 individuals occurs in waters seaward (within approximately 50 km) of the Tiwi Islands and ranks in the top eight of dugong populations in the world.

Dugong distribution and movement is based on the abundance, size and species of seagrass meadow. Dugongs can migrate hundreds of kilometres between seagrass habitats. Dugongs have been tracked moving long distances of up to 300 km between the Australia mainland and the Tiwi Islands (Whiting et al., 2009). The EMBA does not overlap any BIA for dugong.

Table 8: Summary of information for marine mammals listed as threatened under the EPBC Act

Aspect	Sei whale	Blue and pygmy blue whales	Fin whale	Southern right whale
Species expected in area	Yes	Yes	Yes	Unlikely, southern distribution
Migration depth (m)	Unknown, prefers offshore waters	500-1,000	Unknown	n/a
Migration seasonality	Unknown	Apr to Aug (north), Oct to Jan (south)	Unknown	Apr to Oct

8.2. Biologically Important Areas / Critical Habitat – Marine Mammals

Table 9 below provides an overview of BIAs in the EMBA for marine mammals.

The DCCEEW may also make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in **Section 15.2**.

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species. To date no critical habitat in WA has been listed under either Act. No provision is made under the TPWC Act for listing critical habitat.

Table 9: Biologically Important Areas – marine mammals

Species	Scientific name	Aggregation area and use	BIAs within EMBA
Pygmy blue whales	*Balaenoptera musculus*	Migration – along the continental shelf edge off the WA coastline, extending offshore near Scott Reef and into Indonesian waters Foraging – along Ningaloo reef, around Scott Reef, around the Perth canyon Distribution – along the WA coastline towards and beyond Indonesia.	Augusta to Derby. Tend to pass along the shelf edge at depths of 500 m to 1000 m; appear close to coast in the Exmouth-Montebello Islands area on southern migration. Ningaloo
Humpbackwhale	*Megaptera novaeangliae*	Breeding/calving/nursing/resting – Kimberley/Coastal North Lacepede Island, Campden Sound, Exmouth Gulf, Shark Bay Migration - northern migration deeper waters of the continental shelf, southward migration – along the WA mainland	Exmouth Gulf Kimberley/Coastal North Lacepede Island, Camden Sound North of Houtman Abrolhos The migration corridor extends from the coast to out to approximately 100 km offshore in the Kimberley region extending south to North West Cape. From North West Cape to south of Shark Bay the migration corridor is reduced to approximately 50 km.

9. Terrestrial Mammals and Reptiles

Nine species of listed terrestrial mammals and two listed terrestrial reptile species are known to occur in the EMBA, according to the Protected Matters search (Appendix D of the DC Gas Supply Pipeline EP). Of the listed species, eight are listed as vulnerable and three are listed as endangered under the Commonwealth EPBC Act.

The section below gives further details on terrestrial mammal and reptile species listed as threatened and a summary is presented in Table 10.

Table 10: Protected terrestrial species within the EMBA

Species	Conservation Status		Offshore EMBA Presence	Particular Values or Sensitivities Within EMBA	Shoreline EMBA Presence	Particular Values or Sensitivities Within EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 20162					
Mammals							
Northern quoll (*Dasyurus hallucatus*)	E	E	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area	X
Ghost bat (*Macroderma gigas*)	V	V	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	X
Boodie, burrowing bettong (*Bottongia lesueur* Barrow and Boodie Islands subspecies)	V	CD	✓	Species or species habitat known to occur within area	X	N/A	X
Golden bandicoot (Barrow Island) *(*Isoodon auratus barrowensis*)*	V	V	✓	Species or species habitat known to occur within area	X	N/A	X
Spectacled hare-wallaby (Barrow Island) (*Lagorchestes conspicillatus conspicillatus*)	V	V	✓	Species or species habitat known to occur within area	X	N/A	X
Mala, rufous hare-wallaby (central Australia) (*Lagorchestes hirsutus* Central Australian subspecies*)*	E	E	✓	Translocated population known to occur within area	X	N/A	X
Barrow Island wallaroo, Barrow Island euro *(Osphranter robustus isabellinus)*	V	V	✓	Species or species habitat likely to occur within area	X	N/A	X
Black-flanked rock-wallaby (*Petrogale lateralis lateralis*)	E	E	✓	Species or species habitat known to occur within area	X	N/A	X
Pilbara leaf nosed bat (*Rhinonicteris aurantia* (Pilbara form))	V	V	✓	Species or species habitat known to occur within area	X	N/A	X
Reptiles							
Pilbara Olive Python (Liasis olivaceus barroni)	V	V	✓	Species or species habitat likely to occur within area	✓	Species or species habitat may occur within area	X
Hamelin Ctenotus (Ctenotus zastictus)	V	V	✓	Species or species habitat known to occur within area	X	N/A	X

9.1. Threatened Species

9.1.1. Northern Quoll

The Northern Quoll is the smallest of the four Australian quoll species. It has a pointy snout and reddish-brown fur, with white spots on its back and rump. Northern Quolls can weigh up to 1.2 kg, with the males (usually between 400 to 900 g) (Braithwaite & Begg 1995) being larger than the females (usually 300 to 500 g) (Braithwaite & Begg 1995, TSSC 2005). The Northern Quoll was historically common across northern Australia, occurring almost continuously from the Pilbara, Western Australia, to near Brisbane, Queensland (Braithwaite & Griffiths 1994). The Northern Quoll now occurs in five regional populations across Queensland, the Northern Territory and Western Australia both on the mainland and on offshore islands.

9.1.2. Ghost Bat

The ghost bat is the largest microchiropteran bat in Australia, with a head and body length of 10−13 cm and a forearm length of 10−11 cm. The species' current range is discontinuous, with geographically disjunct colonies occurring in the Pilbara (Armstrong & Anstee 2000; McKenzie & Bullen 2009), Kimberley (including several islands; McKenzie & Bullen 2012), northern Northern Territory (including Groote Eylandt), the Gulf of Carpentaria (Australian Wildlife Conservancy 2010), coastal and near coastal eastern Queensland from Cape York to near Rockhampton (Richards et al., 2008), and western Queensland (including Riversleigh and Cammoweal districts; Bullen pers. comm., 2015). The key threat to the ghost bat is habitat loss and degradation due to mining activities (McKenzie & Hall 2008; Qld DEHP 2015).

9.1.3. Boodie, Burrowing Bettong

The Barrow and Boodie Islands subspecies of the Burrowing Bettong is a compact marsupial with grey fur, and a ventral surface that tends to be lighter. Legs, feet and tail are yellowish in colour. It has short, rounded ears, grows to 28 cm in length and has a fat tail which grows to 21.5 cm in length. In some animals, the tail has a distinctive white tip (Strahan 1998). The Burrowing Bettong is the only macropod to construct and live in a burrow system. Whilst the species is nocturnal, social and omnivorous (Richards 2007), it forages alone (Sander et al. 1997). The Barrow and Boodie Islands subspecies of the Burrowing Bettong occur on the aforementioned islands off Western Australia. The total extent of occurrence of the Barrow and Boodie Island subspecies of the Burrowing Bettong is approximately 233 km² (Short & Turner 1991).

9.1.4. Golden Bandicoot (Barrow Island)

The golden bandicoot (*Isoodon auratus barrowensis*) (Barrow Island) belonging to the family Peramelidae, is a compact marsupial which grows to an average length of 24.5 cm with an average tail length of 10.5 cm. The golden bandicoot (Barrow Island) is slightly smaller and has slightly darker fur than the golden bandicoot (mainland) and weighs between 250 and 600 g when mature (Palmer et al. 2003; Strahan 1998). The species is mainly solitary, though home ranges overlap and may alter by seasons, usually increasing in size in drier seasons (Palmer et al. 2003). The population of the golden bandicoot (Barrow Island) was restricted to Barrow and Middle Islands (McKenzie et al. 1995) after it became extinct on Hermite Island around 1912 (Burbidge 1971). The species has recently been reintroduced to the Montebello Islands (including Hermite Island); Doole Island in Exmouth Gulf and is present at the ex-pastoral station, Lorna Glen, managed by DPaW (DPaW WA, 2013, pers comm.).

9.1.5. Spectacled Hare-wallaby (Barrow Island)

The Spectacled Hare-wallaby (Barrow Island) is a stocky marsupial with distinctive bright orange rings around its eyes. It has brown fur above and white fur below. Individuals grow to 47 cm long and weigh up to 4.5 kg. The species is generally solitary, though small groups of up to three have been seen feeding together (Cronin 1991; Strahan 1998). This subspecies was formerly distributed on Barrow Island and on Hermite Island in the Montebello Group, Western Australia. It is now restricted to Barrow Island and Boomerang Island, which is joined to Barrow at low tide (Maxwell et al. 1996).

9.1.6. Mala, Rufous Hare-wallaby (Central Australia)

The Mala is one of the smaller sized terrestrial macropods with slight sexual dimorphism, where the average weight of females is 1.3 kg (0.9–1.8 kg) and males 1.2 kg (0.8–1.6 kg). The Mala currently only occurs within predator exclusion fenced sites into which they have been reintroduced and on Trimouille Island, on which Mala have been introduced (outside of the species historic range). Subpopulations have been established in WA on Trimouille Island (5.2 km^2) in the Montebello Islands, and at fenced exclosures at Matuwa (11 km^2), in the NT at

Uluru-Kata Tjuta National Park (1.7 km^2) and Newhaven Wildlife Sanctuary (94 km^2). Historically, predation by foxes and feral cats was the cause of the final declines of wild Mala. With this threat managed by separating Mala from introduced predators (on an island and fenced exclosures), climate change is the most significant current threat to existing subpopulations of Mala.

9.1.7. Barrow Island Wallaroo, Barrow Island Euro

The Barrow Island Wallaroo is a stocky, dark-backed marsupial with a paler coloured belly and coarse, shaggy fur (Strahan 2002; van Dyck & Strahan 2008). It is smaller than the mainland form of the Wallaroo. While the mainland form have an average weight of 35 kg (male) and 16 kg (female), the Barrow Island Wallaroo is much smaller, with an average weight of 20 kg (male) and 8 kg (female). The Barrow Island Wallaroo is a subspecies of the Common Wallaroo, *Macropus robustus*, which is distributed widely across Australia. The Barrow Island Wallaroo only occurs on the Barrow Island off the Pilbara coast of Western Australia, to the west of Karratha. The Barrow Island Wallaroo is present throughout Barrow Island and has an extent of occurrence of 233 km². Barrow Island Wallaroos occur mainly in the deeply dissected country in the central west of the Island in the low lying grassy areas dominated by species other than Triodia (Short & Turner 1991). Their area of occuapancy is likely to be less than the whole of the Barrow Island area.

9.1.8. Black-flanked Rock-wallaby

The black-flanked rock-wallaby's head and body length is 497-529 mm in males and 446-486 mm in females. Individuals weigh between 3.1 and 5.0 kg. The long tail, up to 605 mm long, is important for balance when hopping among rocks, and the rock-wallaby can also climb trees with sloping trunks (Eldridge & Pearson 2008; WA DPaW 2012). The black-flanked rock-wallaby is endemic to Western Australia (WA). Current subpopulations are restricted to the best habitat in: the Barlee Range (Ashburton; however, there is some doubt as to whether these are *P. lateralis* or *P. rothschildi* or hybrids, Eldridge pers. comm., cited in Woinarski et al., 2014); Kaalpi (Calvert Range, Little Sandy Desert); parts of Cape Range; granite rocks in the Avon Wheatbelt (Nangeen Hill, Mount Caroline, Mount Stirling, Sales Rock, Tutakin Rock (Gundaring Nature Reserve)); Barrow Island; and Salisbury Island. Predation by foxes and feral cats is likely to have a significant impact on the species, particularly during the peak breeding seasons. Further habitat degradation from intensive grazing and invasion of woody weeds within the species' distribution is also likely to have a significant impact on the species.

9.1.9. Pilbara Leaf Nosed Bat

The Pilbara Leaf-nosed Bat is of moderate size, having short fur, relatively small, pointed ears and a fleshy diamond-shaped noseleaf surrounding the nostrils. It weighs around 8.7–9.3 g and has a forearm length of 45.2–47.8 mm (Armstrong 2001, 2002). Sexes are mostly similar in size, especially in external features (Armstrong 2002). *Rhinonicteris aurantia* is endemic to Australia, and ranges throughout the Pilbara and Kimberley regions of Western Australia, the Top End of the Northern Territory, and parts of several bioregions across the Gulf of Carpentaria in the Northern Territory and western Queensland. Populations have not been connected across the Great Sandy Desert for many thousands of years (Armstrong 2006b; Armstrong and Coles 2007).

9.1.10. Pilbara Olive Python

The Olive Python (Pilbara subspecies) is a dull olive-brown to pale fawn or rich brown python with a white/cream belly, pale lips finely dotted with pale grey or brown, pitted anterial scales bordering the lips and smooth scales in 55–80 rows at mid-body. The Pilbara Olive Python can grow to 4 m, but has an average size of 2.5 m (Cogger 2000). Females are slightly longer than males (Shine & Slip 1990). The Olive Python (Pilbara subspecies) is restricted to ranges within the Pilbara region, north-western Western Australia, such as the Hamersley Range, and islands of the Dampier Archipelago. It is known to occur at 17 locations within the Pilbara (Pearson 1993). Four populations occur at Pannawonica, Millstream, Tom Price and Burrup Peninsula (Pearson 2003). More recently, a sub-adult python was recorded on the site of the proposed Pardoo iron ore shipping facility, in the Pilbara, approximately 70 km east of Port Hedland (Enesar Consulting 2007). Threats to the habitat include major fire events, foxes and further development of mining infrastructure.

9.1.11. Hamelin Ctenotus

The hamelin ctentous is a blackish reptile growing to 6 cm with dark-brown head and tail, broad black vertebral stripe narrowly edged with white, narrow white back-sides stripe from eye to tail bordered by a broad black upper zone containing pale spots/blotches, narrow side stripe from ear to groin and separated from a pale lower side stripe by a black zone, brown limbs striped with paler brown and whitish underbelly (Cogger 2000). It is known to occur only in a small area of mallee south of Shark Bay, WA (Cogger *et al*. 1993). It is restricted to an isolated belt of mallee vegetation, consisting of a *Eucalyptus* overstorey with an understorey of hummock grassland

(*Triodia* sp.), on red sandplains (Storr 1984; L. Smith in Cogger *et al*. 1993). The area of occupied habitat is no more than 150 km², being isolated from other suitable habitat by the surrounding *Acacia* shrubland (Storr 1984; G. Shea in Cogger *et al*. 1993).

10. Birds

Marine waters and coastal habitats in the EMBA contain key habitats that are important to birds, including offshore islands, sandy beaches, tidal flats, mangroves, and coastal and pelagic waters. These habitats support a variety of birds which utilise the area in different ways and at different times of the year (DSEWPaC 2012a). Birds can be broadly grouped according to their preferred foraging habitat as coastal/ terrestrial birds, seabirds, and shorebirds.

Coastal or terrestrial species inhabit the offshore islands and coastal areas of the mainland throughout the year. These species are either primarily terrestrial, or they may forage in coastal waters.

Seabirds include those species whose primary habitat and food source is derived from pelagic waters. These species spend the majority of their lives at sea, ranging over large distances to forage over the open ocean. Seabirds present in the area include terns, noddies, petrels, shearwaters, tropicbirds, frigatebirds boobies and albatrosses (DEWHA 2008a).

Shorebirds, including waders, inhabit the intertidal zone and adjacent areas. Some shorebird species are resident whilst other shorebirds are migratory and include species that utilise the East Asian–Australasian Flyway, a migratory pathway for millions of migratory shorebirds that travel from Northern Hemisphere breeding grounds to Southern Hemisphere resting and foraging areas. Shorebirds that regularly migrate through the area include the Scolopacidae (curlews, sandpipers etc.) and Charadriidae (plovers and lapwings) families.

Surveys in the area by Santos and other agencies have built a picture of diverse avifauna. A summary of research is discussed below, followed by information on threatened and migratory birds. Wetlands of international importance are discussed in **Section 11.**

10.1. Regional Surveys

10.1.1. North West Cape

Avifauna surveys of the North West Cape have recorded 144 bird species, one third of which are seabirds and shorebirds (resident and migratory) (May et al. 1983). Approximately 33 species of seabirds and shorebirds are found in the Ningaloo Marine Park with the main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island (CALM & MPRA 2005a).

10.1.2. Muiron Islands and Exmouth Gulf Islands

Muiron Islands and Exmouth Gulf Islands are generally lacking in published bird observations data. Early indications from surveys commissioned by Santos in 2013/14 indicate that South and North Muiron Islands are regionally significant in terms of wedge-tailed shearwater (*Ardenna pacifica*) nesting, whilst Bessiers and Fly islands are also significant (Surman pers comm. 2013). Nine coastal/terrestrial species and 21 shorebirds were identified on the Muiron and Exmouth Gulf Islands during the first of these surveys and seven bird species were recorded nesting (Surman 2013).

10.1.3. Dampier Archipelago/Cape Preston Region

The Dampier Archipelago/Cape Preston region is a nesting area for at least 16 species of seabirds. Many of the islands and rocks in the area are known breeding grounds for birds, including wedge-tailed shearwaters (*Ardenna pacifica*), Caspian terns (*Sterna caspia*), bridled terns (*Onychoprion anaethetus*) and roseate terns (*Sterna dougallii*). Small islands and islets such as Goodwyn Island, Keast Island and Nelson Rocks provide important undisturbed nesting and refuge sites, and Keast Island provides one of the few nesting sites for pelicans in WA (CALM & MPRA 2005a).

10.1.4. Barrow Island Group

Barrow Island and surrounding islands have a diverse avifauna comprising at least 119 species (Chevron 2010), including 11 resident land birds, eight resident seabirds, 17 seabirds, 22 species of migratory waders, six resident shorebirds and 43 irregular visitors (Surman 2003). The avifauna of Barrow Island is thus poor in terms of land birds and waterfowl compared to mainland areas of the Pilbara, but rich in migratory waders and seabirds.

Compared to other nearby offshore islands, Barrow Island has substantially more migratory waders but fewer breeding seabirds (Surman 2003).

10.1.5. Lowendal Island Group and Airlie and Serrurier Islands

The Lowendal Island Group has a diverse avifauna comprising 89 recorded species (Dinara Pty Ltd. 1991, Burbidge et al. 2000). Six species of resident land birds and six species of raptors have been recorded at the Lowendal Islands (Surman & Nicholson 2012). Up to fourteen seabird species have been observed at any one time during annual surveys of the Lowendal Islands between 2004 and 2012. Surveys at the Montebello Islands have recorded 70 bird species. This includes 12 species of seabirds and 14 species of migratory shorebirds (Burbidge et al. 2000). Wedge-tailed shearwaters have been identified to nest on Varanus, Airlie, Serrurier and Bridled Islands (Astron 2017a). Breeding participation on the islands appears to be largely influenced by pre-breeding oceanographic conditions (Astron 2017a). Monitoring in 2016/17 was undertaken by Santos and demonstrated the colony sizes for wedge-tailed shearwaters to be within or above previously reported ranges (Astron 2017a). This is informed though monitoring that has been undertaken under the Integrated Shearwater Monitoring Program (ISMP), established in 1994.

In 2016/17, areas of potential wedge-tailed shearwater nesting habitat were recorded on Varanus Island (5.53 ha) and Airlie Island (12.47 ha) and surrounding islands of Bridled (2.94 ha), Serrurier (130.89 ha), Abutilon (2.02 ha) and Parakeelya (1.66 ha) (Astron 2017a). The number of wedge-tailed shearwater breeding pairs was also estimated for each of Varanus (1,492 +/- 702), Airlie (600 +/- 124), Bridled (1,039 +/- 342), Serrurier (23,240 +/- 4,341), Abutilon (317 +/- 210) and Parakeelya (172 +/- 138) islands (Astron 2017a).

Other seabird species utilising Abutilon, Beacon, Bridled and Parakeelya islands for nesting include bridled terns, silver gulls, crested terns and lesser crested terns. Monitoring for these seabirds in 2016/17 was also completed by Santos, with monitoring results concluded to support previous trends for all species. Bridled terns mainly utilise Abutilon, Bridled and Parakeelya islands for breeding, with smaller numbers noted on Beacon and Varanus Islands. The bridled terns have not been recorded on Airlie Island and only in very small numbers on Varanus Island (Astron 2017b).

Silver gull numbers appear to be growing across the region (2010/2011). However, reasons for this are unknown but considered possibly to be due to greater prey availability or immigration from the mainland (Astron 2017b). Silver gulls have been found to utilise Bridled, Parakeelya, Abutilon and Beacon islands longer term for breeding. Silver gulls have not been identified to nest on Varanus island and were only recorded nesting on Airlie island for the first time in 2016/17 since monitoring commencement in 2004/05 (Astron 2017b).

The crested tern and lesser crested tern are noted as nomadic breeders that appear to use a consistent subset of islands for breeding. In 2016/17, Beacon Island was the favourable nesting site for the crested tern and lesser crested tern (Astron 2017b). Surveys in the vicinity of Port Hedland (Bennelongia 2011) recorded 23 species of migratory shorebird between 2002 and 2011. Terrestrial/coastal and seabird species were not targeted. A total of 4,248 migratory shorebirds of 18 species were observed during the field survey in April 2011.

10.2. Threatened Species

A Protected Matters search of the EMBA identified 12 bird species as threatened, 22 as migratory, and 8 as both threatened and migratory (Appendix D of the DC Gas Supply Pipeline EP) under the EPBC Act.

An examination of the Species Profile and Threats database (DAWE, 2024) and The Action Plan for Australian Birds (Garnet 2011) showed that some listed bird species are not expected to occur in significant numbers in the marine and coastal environments in the EMBA due to their terrestrial or southern distributions. Hence, these species are not discussed further.

EPBC Act threatened species expected to occur in the area are listed in **Table 11** along with their WA conservation status (as applicable) and discussed below. BIAs for birds are detailed in **Table 17** and depicted in **Figure 12**.

Table 11: Birds listed as threatened under the EPBC Act

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
Shorebirds						
Red knot[8] (*Calidris canutus*)	Vulnerable, Migratory	Endangered	-	Endangered	Species or species habitat known to occur within area	None - No BIA defined
Curlew sandpiper[8] (*Calidris ferruginea*)	Critically endangered, Migratory	Critically endangered	-	Critically endangered	Species or species habitat known to occur within area	None - No BIA defined
Greater sand plover (*Charadrius leschenaultii)*	Vulnerable, Migratory	Vulnerable	-	Vulnerable	Species or species habitat known to occur within area	None - No BIA defined
Northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri)*	Endangered,	Endangered, Specially protected (migratory)[6]	-	Endangered	Species or species habitat known to occur within area	None - No BIA defined
Eastern curlew[8] (*Numenius madagascariensis)*	Critically endangered, Migratory	Critically endangered	-	Critically endangered	Species or species habitat known to occur within area	None - No BIA defined
Australian painted snipe (*Rostratula australis)*	Endangered	Endangered	-	Endangered	Species or species habitat may occur within area	None - No BIA defined
Common greenshank[8] (*Tringa nebularia*)	Endangered, Migratory	-	-	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA
White-winged fairy-wren (Barrow Island), Barrow Island black-and-white fairy-wren (*Malurus leucopterus edouardi*)	Vulnerable	Vulnerable	-	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA
Sharp-tailed sandpiper[8] (*Calidris acuminata*)	Vulnerable, Migratory	-	-	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
Night parrot (*Pezoporus occidentalis*)	Endangered	Critically endangered	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Asian Dowitcher[8] (*Limnodromus semipalmatus*)	Vulnerable, Migratory	-	-	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
Grey falcon (*Falco hypoleucos*)	Vulnerable	Vulnerable	Vulnerable	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
Red goshawk (*Erythrotriorchis radiatus*)	Endangered	Vulnerable	Vulnerable	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Seabirds						
Southern giant petrel (*Macronectes giganteus)*	Endangered, Migratory	Specially protected (migratory)	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Australian fairy tern (*Sternula nereis nereis)*	Vulnerable	Vulnerable	-	-	Breeding known to occur within area. Foraging (in high numbers)	Yes – refer to **Table 17**
Indian yellow-nosed albatross (*Thalassarche carteri)*	Vulnerable, Migratory	Endangered	-	-	Species or species habitat may occur in area	None - BIA not found in EMBA

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus)*	Endangered	-	-	-	Species or species habitat may occur within area	None - No BIA defined
Red-tailed tropicbird (*Phaethon rubricauda westralis*)	Endangered	-	-	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA

10.2.1. Shorebirds

Red Knot

The red knot (*Calidris canutus*) is listed as Vulnerable and Migratory under the EPBC Act. It is a migratory shorebird, and the species includes five subspecies, including two found in Australia, *Calidris canutus piersmai* and *Calidris canutus rogersi*. The red knot breeds in Siberia and spends the non-breeding season in Australia and New Zealand. During the non-breeding season, the species spends the majority of its time on tidal mudflats or sandflats where they feed on intertidal invertebrates, especially shellfish (Garnet et al. 2011).

Curlew Sandpiper

This (*Calidris ferruginea*) is listed as Critically Endangered and Migratory. It is a shorebird that breeds in north Siberia and spends the non-breeding season from western Africa to Australia (Bamford et al. 2008). The curlew sandpiper occurs around coastal Australia and preferred habitats include coastal brackish lagoons, tidal mud and sand flats, estuaries, saltmarshes and less often inland. Their diet is mainly comprised of polychaete worms, molluscs and crustaceans (Higgins & Davies 1996 in Garnet et al. 2011).

Greater Sand Plover

The greater sand plover (*Charadrius leschenaultii*) is listed as Vulnerable and Migratory under the EPBC ACT and breeds in China, Mongolia and Russia. The greater sand plover spends the non-breeding season along coasts from Japan through southeast Asia to Australasia (Bamford et al. 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover DAWE 2020a).

Non-breeding birds forage on beaches, saltmarshes, coastal bays and estuaries, and feed on marine invertebrates including molluscs, worms, crustaceans and insects (Marchant & Higgins 1993 in Garnet et al. 2011).

Bar-tailed Godwit (Northern Siberian Subspecies)

Two subspecies of the bar-tailed godwit exist, as determined by their breeding locations in Siberia and Alaska (Bamford et al. 2008). Non-breeding birds migrate to the coasts of Australia. The northern Siberian subspecies (*Charadrius leschenaultii*) is listed as Vulnerable and Migratory under the EPBC ACT and occurs especially along the coasts of north Western Australia (DAWE 2020a). It is listed as Endangered under the EPBC Act.

Non-breeding birds are found on muddy coastlines, estuaries, inlets, mangrove-fringed lagoons and sheltered bays, feeding on annelids, bivalves and crustaceans (Higgins and Davies 1996 in Garnet et al. 2011).

Eastern Curlew

The eastern curlew (*Numenius madagascariensis*) listed as Critically Endangered and Migratory under the EPBC Act. It is a migratory shorebird that breeds in Siberia, Kamchatka and Mongolia and migrates to coastal East Asia and Australia. The South Korean Yellow Sea is an important staging post for this species. Non-breeding birds occur around coastal Australia, are more common in the north and have disappeared or become much rarer at many sites along the south coast (Garnet 2011).

Non-breeding birds are present at estuaries, mangroves, saltmarshes and intertidal flats, particularly those with extensive seagrass (Zosteraceae), where they feed on marine invertebrates, especially crabs and small molluscs (Higgins & Davies 1996 in Garnet 2011).

Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is listed as Endangered under the EPBC Act.). The species has been recorded at wetlands in all states of Australia (DoE 2014g). The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The Australian painted snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DoE 2014g).

Common Greenshank

The common greenshank (*Tringa nebularia*) is listed as Endangered and Migratory under the EPBC Act. The Common Greenshank is a migratory species, heavily built, elegant wader, 30–35 cm in length, with a wingspan of 55–65 cm and weight up to 190 g for both males and females. The species is seen singly or in small to large flocks (sometimes hundreds) in a variety of coastal and inland wetlands (Higgins & Davies 1996). This species does not breed in Australia; however, it occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (Higgins & Davies 1996). It is generally absent from the Western Deserts although there are a few records from the Great Sandy Desert and the Nullarbor Plain. It occurs around most of the coast from Cape

Arid in the south to Carnarvon in the north-west. In the Kimberleys it is recorded in the south-west and the north-east, with isolated records from the Bonaparte Archipelago (Higgins & Davies 1996). The Common Greenshank is carnivorous and it feeds during both day and night time. In Australia is has been recorded eating molluscs, crustaceans, insects, and occasionally fish and frogs. The birds wade in shallow water along edge of water in tidal estuaries, muddy claypans, saltworks and saltpans (Higgins & Davies 1996).

White-winged Fairy Wren

The white-winged fairy wren (*Malurus leucopterus edouardi*) is listed as Vulnerable under the EPBC Act.. It is usually observed in small groups of three to eight birds, but it can also occur singly or in twos (Bamford & Wilcox 2005; Pruett-Jones & Tarvin 2001; Sedgwick 1978; Serventy & Marshall 1964). The White-winged Fairy-wren (Barrow Island) is endemic to Australia, and it is only found on Barrow Island (Garnett & Crowley 2000; Schodde & Mason 1999), which lies off the coast of Western Australia. As the entire population of this species (estimated, most recently, at 9 336 birds) occurs on Barrow Island (area of approximately 250 km²) (Bamford & Wilcox 2005; Garnett & Crowley 2000; Pruett-Jones & O'Donnell 2004; Schodde & Mason 1999) it is presumed that the distribution of the White-winged Fairy-wren (Barrow Island) is not fragmented. The White-winged Fairy-wren (Barrow Island) has been recorded breeding from April to October, with most eggs laid from June to August (Ambrose & Murphy 1994; Butler 1970; Johnstone & Storr 2004; Pruett-Jones & O'Donnell 2004; Schodde 1982; Sedgwick 1978; Serventy & Marshall 1964; Whitlock 1919).

The diet of the White-winged Fairy-wren (Barrow Island) consists of beetles, flies, hymenopteran insects, and other invertebrate prey (Wooller & Calver 1981). This species occurs in grasslands and low shrublands, which consist of a dense ground cover comprised of species of *Triodia* (such as *T. wiseana* and *T. angusta*), usually more than 400 mm in height, with patches of bare ground, and often with scattered clumps of shrubs (especially *Acacia bivenosa*, *A. coriacea* and *Melaleuca cardiophylla*) that are used for shelter and for foraging, nesting and roosting (Bamford & Bamford 2005, Bamford & Wilcox 2005; Pruett-Jones & Tarvin 2001; Sedgwick 1978; Storr 1984b; Whitlock 1918; Wooller & Calver 1981).

Sharp-tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*) is listed as Vulnerable under the EPBC Act. This species is a small-medium wader measures 17–22 cm length, a wingspan of 36–43 cm and a weight of 65 g. The sharp-tailed sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats (Cramp 1985; Higgins & Davies 1996). In Western Australia (WA), scattered records occur along the Nullarbor Plain and the southern areas of the Great Victoria Desert. They are widespread from Cape Arid to Carnarvon, around coastal and subcoastal plains of Pilbara Region to south-west and east Kimberley Division (Higgins & Davies 1996). They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water and they are recorded to eat various insects, worms, molluscs, crustaceans and plant seed (Higgins & Davies 1996).

Night Parrot

Night parrot (*Pezoporus occidentalis*) is listed as Endangered under the EPBC Act. The species is a medium-sized, nocturnal, ground-feeding parrot growing 22 - 25 cm long. Adults are mostly bright-green with extensive black and yellow markings, including streaks, spots and bars and a yellow belly (Higgins, 1999). The distribution of the night parrot is very poorly known. There are accepted historical records from remote arid and semi-arid inland regions of Western Australia, Northern Territory, South Australia and Queensland (Higgins, 1999). Most habitat records are of *Triodia* (Spinifex) grasslands and/or chenopod shrublands (Garnett et. al., 2011) in the arid and semi-arid zones, and Higgins (1999) listed *Astrebla* spp. (Mitchell grass), shrubby samphire and chenopod associations, scattered trees and shrubs, *Acacia aneura* (Mulga) woodland, treeless areas and bare gibber as associated with sightings of the species.

Asian Dowitcher

The Asian dowitcher (*Limnodromus semipalmatus*) is listed as Vulnerable and Migratory under the EPBC Act. The species has a length of 33–36 cm and a wingspan of 59 cm, in general, males weigh 180 g while females weigh 190 g. The species is distinctive, combining elements of both snipes and godwits. It is characterised by a long neck, long dark legs and a diagnostic long dark straight, snipe-line bill (Higgins & Davies 1996). The Asian Dowitcher was first recorded in Australia in 1972 and is a regular visitor to the north-west between Port Hedland and Broome. In Western Australia the species has been recorded at Albany, Lake McLarty, Lake McLeod, north-east Pilbara and the south-west Kimberley division. It has also been recorded at the Port Hedland Saltworks, Roebuck Bay, Ashmore Reed and Eighty Mile Beach (Higgins & Davies 1996). It is known to eat polychaete worms and larvae, also insect larvae and molluscs. The Asian Dowitcher occurs in sheltered coastal environments, such as embayments, coastal lagoons, estuaries and tidal creeks. They are known to frequent shallow water and exposed mudflats or sandflats where they feed (Higgins & Davies 1996).

Grey Falcon

The grey falcon (Falco hypoleucos) is listed as Vulnerable under the EPBC Act. The Grey Falcon is an elusive species endemic to mainland Australia. It is the rarest of six Australian members of the genus Falco (Olsen and Olsen 1986; Marchant and Higgins 1993). The Grey Falcon is a compact, pale grey falcon with a heavy thick chest, long wings and dark wing tips (Debus 2019; Schoenjahn 2010). The species occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia (Marchant and Higgins 1993). Breeding occurs from June to November and while breeding grey falcons feed almost exclusively on birds (Cupper and Cupper 1980, 1981; Harrison 2000; Aumann 2001c; Falkenberg 2011; Sutton 2011; Schoenjahn 2013; Janse et al. 2015; Ley and Tynan 2016).

10.2.2. Seabirds

Indian yellow-nosed albatross

The Indian Yellow-nosed Albatross (*Thalassarche carteri*) is listed as Vulnerable and Migratory under the EPBC Act. It forages mostly in the southern Indian Ocean where it is particularly abundant off Western Australia (Marchant & Higgins 1990). The Indian Yellow-nosed Albatross breeds on islands of the southern Indian Ocean. The National Conservation Values Atlas (DAWE 2020b) and the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011) do not identify any BIAs for these species in the area from Busselton to the NT border. In waters off southern Western Australia and South Australia the species is most abundant between March and May.

Southern Giant Petrel

The southern giant petrel (*Macronectes giganteus*) is listed as Endangered and Migratory under the EPBC Act. It is a highly migratory bird with a large natural range. This species occurs from Antarctic to subtropical waters and breeds on the Antarctic continent, peninsular and islands and on subantarctic islands and South America. Breeding occurs annually between August and March (DAWE 2020a).

The National Conservation Values Atlas (DAWE 2020b) and the National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC 2011) do not identify any BIAs for this species in the area from Busselton to the NT border.

Australian Fairy Tern

The Australian fairy tern (*Sternula nereis nereis*) is listed as Vulnerable under the EPBC Act. It is distributed in a large geographic range between Australia, New Zealand and New Caledonia. Three subspecies have been identified, one of which is found in Australia. The Australian fairy tern occurs along the coasts of Victoria, Tasmania, South Australia and WA; occurring as far north as the Dampier Archipelago (DAWE 2020a). The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine islands, wetlands and mainland coastline (Higgins & Davies 1996 in DoE 2014b, Lindsey 1986).

Australian fairy terns nest on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The Australian fairy tern breeds from August to February depending on the location of the breeding colony (Higgins & Davies 1996 in DAWE 2020a). They generally nest in small colonies of up to 100 birds, although larger colonies of more than 1400 pairs have been reported in Western Australia (Hill et al. 1988).

The National Conservation Values Atlas (DAWE 2020b) identifies the vicinity of the lower north-west coast (north to Dampier Archipelago) and west coast (south to Peel inlet) as BIAs for foraging. Biologically important breeding areas were also identified scattered along the coast between Shark Bay and the Pilbara (Table 17).

Christmas Island white-tailed tropicbird

The Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus*) is listed as Endangered under the EPBC Act. The species is a medium-sized, whitish seabird with long central tail-feathers (‘streamers’), a yellow bill and black wing-bars on its upper wings. The Christmas Island white-tailed tropicbird is oceanic, feeding on fish and cephalopods in warm tropical waters and it is endemic to Christmas Island, which is its only known breeding location. The species may occur up to about 1500 km from Christmas Island, at the edge of the continental shelf off Western Australia at 21°S (Dunlop et al., 1988a; 2001). Adults are monogamous and breed aseasonally throughout the year (Stokes, 1988; Dunlop et al., 1988b; Marchant & Higgins, 1990). Individual breeding periodicities appear to be around 10 months. A single egg is laid with incubation shared by both parents (Dunlop et al., 1988b). These birds roost at sea, with only incubating or brooding adults remaining on nests on the island at night.

Red-tailed tropicbird

The red-tailed tropicbird (*Phaethon rubricauda westralis*) is listed as Endangered under the EPBC Act. The Indian Ocean red-tailed tropicbird is a medium-sized seabird with a body length of around 100 cm (including central rectrices projection of around 35 cm), wingspan of around 115 cm, and weight between 600g to 1kg (Marchant & Higgins 1990; Menkhorst et al. 2017). It is a pelagic species, and it can be found in tropical and subtropic parts of the Indian Ocean (Marchant & Higgins 1990). Birds prefer regions with water salinities of less than 35%, and surface temperature of 24 to 30 °C (Pocklington 1979; Dunlop et al. 1988, 2001). They feed on fish and cephalopods, foraging by plunging into the water, or capturing flying fish in flight (Gibson-Hill 1947; Gould et al. 1974). The subspecies nests alone, or in loose colonies on islands, stacks, atolls, cays or coastal cliffs (Marchant & Higgins 1990). The Indian Ocean red-tailed tropicbird has a restricted area of occupancy (AOO) of 94 km^2 (Willacy et al. 2021), as the subspecies only breeds on a small number of islands: Christmas Island (James & McAllan 2014), Cocos (Keeling) Islands (Stokes et al. 1984), Bedwell Island, Rowley Shoals (Berry 1986), Islands of Ashmore Reef (Clarke et al. 2011) and Rottnest Island (Mather & Greenwell 2021; Mather 2022; S Bell, R Priemus).All known and potential breeding habitat and islands should be considered habitat critical to the survival of the subspecies (DCCEEW, 2023).

Red Goshawks

The red goshawk (*Erythrotriorchis radiatus*) is listed as endangered under the EPBC Act. It is a large, swift and powerful rufous-brown hawk, growing to a length of 45–60 cm, with a wingspan of 100–135 cm. They are solitary and very thinly dispersed. It is usually observed singly, and occasionally in pairs or family groups. Red goshawk pairs are believed to remain within the nesting territory all year, but some may expand their home range when not breeding (Aumann & Baker-Gabb 1991; Debus & Czechura 1988b). The species is endemic to Australia, and it is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division (north of 19°S) to northeastern NSW (north of 33°), and occasionally on continental islands (Aumann & Baker-Gabb 1991; Marchant & Higgins 1993).

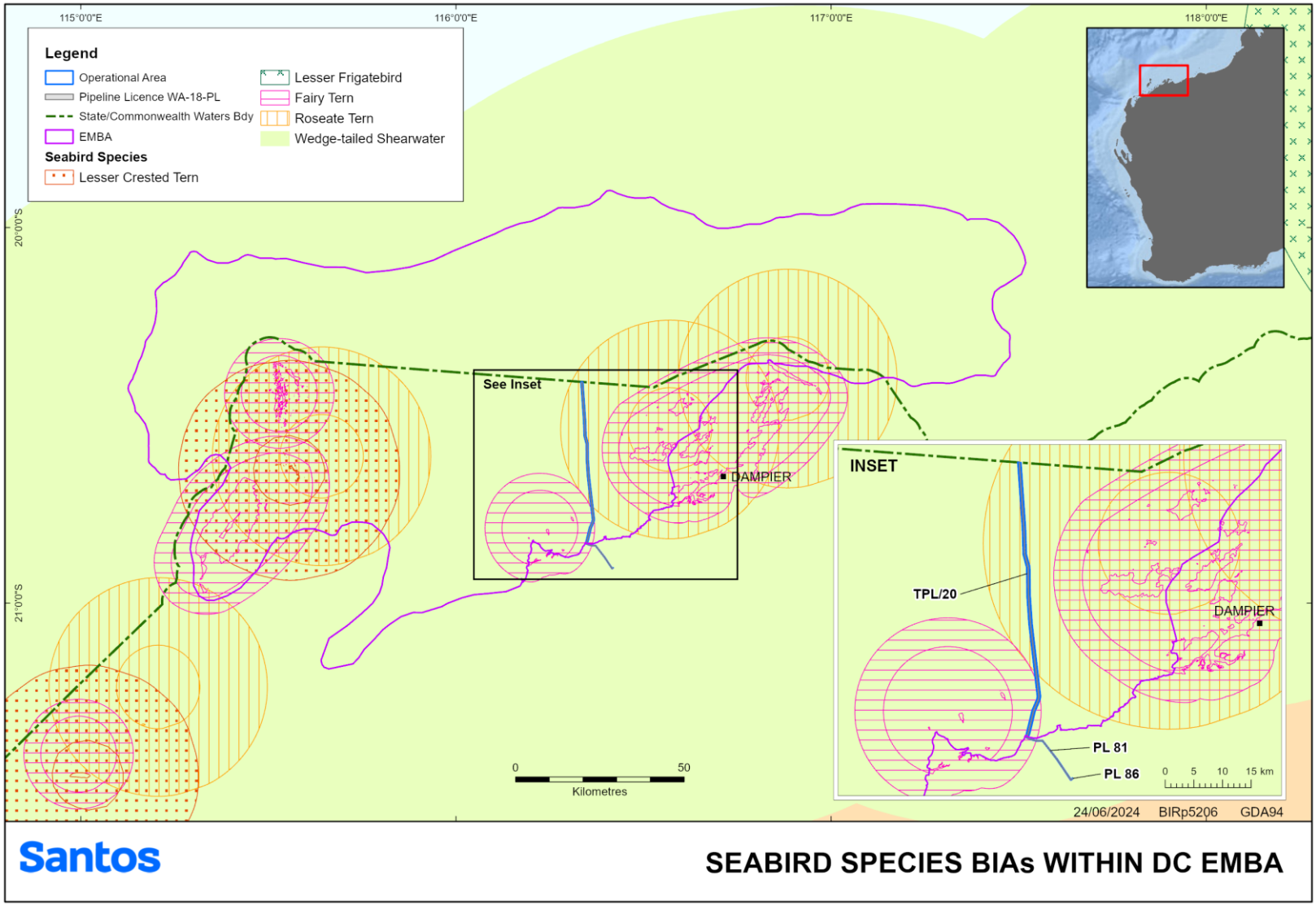


Figure 12: Biologically Important Areas – Birds

Table 12: Summary of information for birds listed as threatened under the EPBC Act that may be in the EMBA

Species	Species Expected in EMBA	Breeding in the Area/ Seasonality	Foraging
Shorebirds			
Red knot[8]	Yes	No	Intertidal invertebrates
Curlew sandpiper[8]	Yes	No	Polychaete worms, molluscs and crustaceans taken from shorelines
Greater sand plover	Yes	No	Marine invertebrates taken from shorelines
Northern Siberian bar-tailed godwit	Yes	No	Worms, molluscs, crustaceans, insects and some plant material
Eastern curlew[8]	Yes	No	Marine invertebrates associated with seagrass
Australian painted snipe	Yes	No	Seeds and small invertebrates around wetlands and swamps
Common greenshank	Yes	No	Molluscs, crustaceans, insects, and occasionally fish and frogs around wetlands
White-winged fairy-wren (Barrow Island), Barrow Island black-and-white fairy-wren	Yes	Yes Apr-Oct	Beetles, flies, hymenopteran insects, and other invertebrate prey on Barrow Island
Sharp-tailed sandpiper	Yes	No	Seeds, worms, molluscs, crustaceans and insects from mudflats
Night parrot	Yes	No	Grass seeds
Asian Dowitcher	Yes	No	Polychaete worms and larvae, also insect larvae and molluscs taken from mudflats
Grey falcon	Yes	No	Birds of varying sizes
Red goshawk	Yes	Yes May to Oct	Live prey including birds (95%), mammals, reptiles and insects.
Seabirds			
Indian yellow-nosed albatross	Low densities	No	Cephalopods, and fish taken from marine and coastal waters.
Southern giant petrel	Low densities	No	Scavenges penguin, seal and whale carcasses. Hunts live birds, penguin chicks' cephalopods and krill. Marine and coastal waters (DoE 2014b)
Australian fairy tern	Yes	Yes Aug to Feb	Bait fish taken from coastal waters
Christmas Island white-tailed tropicbird	Yes	No	Fish and marine molluscs from coastal waters
Red-tailed tropicbird	Yes	No	Mainly flying fish and squid from coastal waters

[8] Species listed under the East Asian-Australasian Flyway Partnership

10.3. Migratory Species

The EPBC PMST search identified an additional 22 species listed as migratory under the EPBC Act that may occur within the EMBA. These species are listed in **Table 13**. All of these species are also listed as migratory under the BC Act, with the exception of:

- the red-tailed tropicbird which is listed as migratory under the EPBC Act and migratory and a Priority 4 under the BC Act.

Species that are listed as both migratory and threatened under either the EPBC Act and/or BC Act are outlined in **Table 11** and are not repeated within **Table 13**.

Table 13: Summary of migratory birds that may occur within the EMBA

Species	Common Name	Likelihood of occurrence in EMBA
Limosa lapponica[8]	Bar-tailed godwit	Species or species habitat known to occur within area
Onychoprion anaethetus	Bridled tern	Breeding known to occur within area
Hydroprogne caspia	Caspian tern	Breeding known to occur within area
Anous stolidus	Common noddy	Species or species habitat likely to occur within area
Actitis hypoleucos[8]	Common sandpiper	Species or species habitat known to occur within area
Apus pacificus	Fork-tailed swift	Species or species habitat likely to occur within area
Thalasseus bergii	Greater crested tern	Breeding known to occur within area
Fregata minor	Greater frigatebird	Species or species habitat may occur within area
Fregata ariel	Lesser frigatebird	Species or species habitat known to occur within area
Sternula albifrons	Little tern	Species or species habitat may occur within area
Charadrius veredus[8]	Oriental plover	Species or species habitat may occur within area
Glareola maldivarum[8]	Oriental pratincole	Species or species habitat may occur within area
Pandion haliaetus	Osprey	Breeding known to occur within area
Calidris melanotos[8]	Pectoral sandpiper	Species or species habitat may occur within area
Sterna dougallii	Roseate tern	Breeding known to occur within area
Calonectris leucomelas	Streaked shearwater	Species or species habitat likely to occur within area
Phaethon lepturus	White-tailed tropicbird	Species or species habitat likely to occur within area
Hirundo rustica	Barn swallow	Species or species habitat may occur within area
Motacilla cinereal	Grey wagtail	Species or species habitat may occur within area
Motacilla flava	Yellow wagtail	Species or species habitat may occur within area
Ardenna pacifca	Wedge-tailed shearwater	Breeding known to occur within area
Thalasseus bengalensis	Lesser crested tern	Not listed in PMST search; however, breeding BIA does overlap the EMBA and therefore this species is assumed to be within the EMBA

[8] Listed under the East Asian- Australasian Flyway Partnership

Australia is signatory to three international treaties with China, Japan and the Republic of Korea to safeguard migratory bird species, predominantly shorebirds. To facilitate observance of the three agreements, 36 species of migratory shorebirds have been listed as specially protected under both the Commonwealth EPBC Act and the WA BC Act.

Eleven internationally recognised areas that can support shorebird migrations are protected as wetlands of international importance. These wetlands are discussed further in **Section 9.2**.

The EPBC Act Policy Statement 3.21 sets out criteria for determining the significance of sites to migratory shorebirds based on the number of migratory species and the proportion of a species population that is supported by the site (Commonwealth of Australia 2017b). Site significance can be difficult to assess, particularly for ephemeral inland wetlands. These areas may be used rarely, depending on weather conditions, but still provide important habitat for migratory shorebird species.

Migratory shorebirds require a particular conservation approach due to their migration patterns that take them across international boundaries (Bamford et al. 2008). These species and their habitats are sensitive to threats due to their high site fidelity, tendency to aggregate, high energy demands and the need for habitat networks containing both roosting and foraging sites (Commonwealth of Australia 2017b). Migratory shorebirds are known to use networks of connected sites (also known as site complexes). They move within these networks depending on the time of day, availability of resources and environmental conditions at the site (Commonwealth of Australia 2017b).

The types of habitat used by migratory shorebirds in Australia vary across the species identified in the PMST search. Migratory shorebirds use both coastal and inland habitats that most commonly include:

- Coastal habitats: coastal wetlands, estuaries, mudflats, rocky inlets, reefs and sandy beaches, sometimes supporting mangroves.
- Inland habitats: inland wetlands, floodplains and grassland areas, often with ephemeral water sources (Commonwealth of Australia 2017b).

Feeding guilds provide an explanation for much of the shorebird distribution pattern in the north Western Australia. For example, Rogers (1999) classified shorebirds (and others) in Roebuck Bay as belonging to seven guilds on the basis of prey choice and foraging method. In order of abundance, these are summarised in **Table 14**.

Table 14: Feeding guilds based on prey choice and foraging method (Rogers 1999) adapted from DEC (2003) and Bennelongia (2008)

Feeding habitat	Feeding guild	Species
Sea edge	Tactile hunters of macrobenthos	Red knot, bar-tailed godwit, Asian dowitcher
Along sandy sea edges or near tidal creeks	Tactile hunters of microbenthos	Curlew sandpiper, sharp-tailed sandpiper
Reefs or mangrove fringes	Visual hunters of slow surface-dwelling prey	Common sandpiper

The Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015) provides a framework to guide the conservation of migratory shorebirds and their habitat in Australia and, in recognition of their migratory habits, outlines national activities to support their appreciation and conservation throughout the East Asian-Australasian Flyway.

The following migratory shorebird species are subject to the Wildlife Conservation Plan for Migratory Shorebirds 2015 (DoE 2015).

Table 15: Birds subject to the Wildlife Conservation Plan for Migratory Shorebirds 2015

Migratory species	DCCEEW SPRAT information on distribution within the area of interest
Asian dowitcher[8]	The Asian dowitcher is a regular visitor to the north-west between Port Hedland and Broome. Elsewhere they are sporadic and rare. In WA, the species has been recorded at Albany, Lake McLarty, Lake McLeod, north-east Pilbara and the south-west Kimberley division. It has also been recorded at the Port Hedland Saltworks, Roebuck Bay, Ashmore Reed and Eighty Mile Beach. The Australian population is approximately 500 (Bamford et al. 2008).
Bar-tailed godwit[8]	• The bar-tailed godwit has been recorded in the coastal areas of all Australian states. In WA, it is widespread around the coast, from Eyre to Derby, with a few scattered records elsewhere in the Kimberley.
Black-tailed godwit[8]	The black-tailed godwit is found in all states and territories of Australia; however, it prefers coastal regions and the largest populations are found on the north coast between Darwin and Weipa.
Common greenshank[8]	The common greenshank occurs around most of the coast from Cape Arid in the south to Carnarvon in the north-west. In the Kimberley region, it is recorded in the south-west and the north-east, with isolated records from the Bonaparte Archipelago. WA has three sites of international importance for the common greenshank which include:
Common sandpiper[8]	WA distribution includes: • Roebuck Bay • Nuytsland Nature Reserve
Greater sand plover[8]	In Australia, the greater sand plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west. In northern Australia, the species is especially widespread between North West Cape and Roebuck Bay in Western Australia Internationally important sites within Western Australia include these which are outside the EMBA: • Eighty Mile Beach (64,548 individuals) • Roebuck Bay (26,900 individuals) • Ashmore Reef (1,196 individuals).
Oriental plover[8]	Internationally important marine sites (though outside the EMBA): • Eighty Mile Beach, WA (approximately 57 619 individuals) • Roebuck Bay, WA (Approximately 8 750 individuals).
Oriental pratincole[8]	Internationally important site though outside the EMBA: • Eighty Mile Beach, WA (2.88 million birds). The species occurs at numerous and widespread sites in northern Australia, especially near the Pilbara and Kimberley coasts of northern WA, and throughout the entire coastline of the NT.
Pectoral sandpiper[8]	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire.
Red knot[8]	The red knot large numbers are regularly recorded in north-west Australia, with 80 Mile Beach and Roebuck Bay being particular strongholds. The Australian population during the non-breeding period is estimated to be 135 000 (Hansen et al. 2016).
Sharp-tailed sandpiper[8]	They are widespread from Cape Arid to Carnarvon, around coastal and subcoastal plains of Pilbara Region to south-west and east Kimberley Division (Higgins & Davies 1996). Internationally important sites include (outside the EMBA): • Eighty Mile Beach (25 000 individuals) • Port Hedland Saltworks (20 000 individuals) • Lake Gregory (10 000 individuals) • Peel-Harvey system (4 030 individuals).

[8] Listed under the East Asian-Australasian Flyway Partnership (EAAFP)
NB Fork tailed swift and Streaked shearwater were not on the list of migratory bird subject to the Wildlife Conservation Plan for Migratory birds 2015 so were removed in Rev11 2023
Latham's Snipe was not included in this list as it does not occur within the EMBA

Shorebird migration patterns are seasonal and vary according to species (DSEWPaC 2012). Generally, shorebirds migrate to northern Australia in August to November. Many birds remain in northern Australia but others disperse southwards (Bennelongia 2011). Migratory shorebird numbers on northern beaches 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 2009).

The Wildlife Conservation Plan for Migratory Seabirds (DoE 2015) seeks to facilitate a nationally coordinated effort to protect and conserve EPBC Act listed seabirds and provides an over-arching framework for their research and management, while encouraging an effort to address threats to seabirds and their habitats.

The following seabird species found within the EMBA are subject to the Wildlife Conservation Plan for Migratory Shorebirds 2020 (DoE 2015).

Table 16: Birds (migratory) subject to the Wildlife Conservation Plan for Seabirds 2020

Migratory species	DCCEEW SPRAT information on distribution within the area of interest
Red-tailed tropicbird	The Australian population is poorly known owing to the numerous breeding sites and protracted and asynchronous breeding season making an accurate census difficult. The largest population breeds on Christmas Island (>2,000 pairs) with additional key breeding locations on Cocos (Keeling) Group, islands of Ashmore Reef Marine Park, Lord Howe Island, Norfolk Island, Coral Sea Marine Park and two known islands and cays in the Great Barrier Reef Marine Park.
White-tailed tropicbird	In Australia, the white-tailed tropicbird (Indian Ocean) breeds in the Cocos-Keeling Islands, at Ashmore Reef and Rowley Shoals off the northern coast of Western Australia. Over the past few years, birds have been sighted with increased frequency on West Island and Home Island (also in the main atoll) in the Cocos-Keeling Islands. The White-tailed Tropicbird (Indian Ocean) ranges widely over the oceans surrounding its breeding locations (Marchant & Higgins 1990). The breeding population of the white-tailed tropicbird (Indian Ocean) in Australia is estimated at 120 birds.
Wedge-tailed shearwater	The wedge-tailed shearwater breeds on the east and west coasts of Australia and on off-shore islands. The species is common in the Indian Ocean, the Coral Sea and the Tasman Sea (Lindsey 1986). In Western Australia breeding occurs on islands off the west coast of WA including the Cocos-Keeling Island. At WA breeding sites there are at least one million breeding pairs.
Streaked shearwater	The streaked shearwater undergoes trans-equatorial migration traveling south during winter, to the coasts of Vietnam, New Guinea, the Philippines, Australia, southern India and Sri Lanka. The global population has been estimated to number 3 million individuals.
Lesser frigatebird	It has been suggested that lesser frigatebird roost at Weipa and survey data suggests Ashmore Reef Marine Park comprises significant numbers and is believed to account for ≥1% of the global population.
Common noddy	In Australia, the common noddy occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. The species is also rarely encountered off the coast of the Northern Territory, where only one breeding location with about 100-130 birds is known. In 1996, the total Australian population of the Common Noddy was estimated to be between 174 480 and 214 130 breeding pairs.
Bridled tern	In Western Australia, bridled terns are breeding at Cape Leeuwin (extending round the southern coast to Seal Rocks) north to Shark Bay and in Pilbara region and Kimberley Division. At sea, distribution extends from Cape Leeuwin north to Dirk Hartog Island, with isolated mainland coastal records at Point Maud and Ningaloo, and from Barrow Island to the Dampier Archipelago, and at sea off the Kimberley coast from waters west of the Dampier Peninsula to Ashmore Reef and Joseph Bonaparte Gulf. The total population in Western Australia is estimated to be at least 30 000–40 000 pairs and apparently increasing.
Little tern	The Australian breeding population can be divided into two major subpopulations (northern and eastern) with the northern subpopulation that breeds across northern Australia, from about Broome in north-western Western Australia through coastal Northern Territory to the Gulf of Carpentaria and eastern Cape York Peninsula.
Caspian tern	Within Western Australia, the Caspian tern is widespread in coastal regions, from the Great Australian Bight to the Dampier Peninsula. There are sparse records on the coasts east of King Sound and in eastern regions. Breeding occurs from the Recherche Archipelago to Dirk Hartog Island and Faure Island in Shark Bay, and also in the Pilbara region from around Point Cloates to North Turtle Island, and more rarely, in the Kimberley.

Migratory species	DCCEEW SPRAT information on distribution within the area of interest
Roseate tern	In Western Australia, the subspecies is regularly recorded north from Mandurah to around Eighty Mile Beach, in the Pilbara Region. Around the Kimberley coastline, the subspecies occurs at scattered sites, north to the Bonaparte Archipelago and possibly further. Records in south-west Western Australia indicate that the subspecies used to be a sporadic visitor to the region, but occurs regularly at present. In addition, breeding colonies have been established on Lancelin Island and Second Rock, off Western Australia (Higgins & Davies 1996). In the Northern Territory, the subspecies has a scattered occurrence along the north coast, mainly from Darwin to Gove Peninsula, though birds have been recorded west to North Peron Island and east to the Sir Edward Pellow Islands (Chatto 2001). The subspecies is more widespread in the west and south-west of the Gulf of Carpentaria (Higgins & Davies 1996).I
Osprey	The breeding range of the eastern osprey around the northern coast of Australia (including many offshore islands) extends from Albany in Western Australia to Lake Macquarie in NSW; with a second isolated breeding population on the coast of South Australia. The species is most abundant in northern Australia, where high population densities occur in remote areas. A population on Barrow Island was estimated at 20 pairs in 1978.

Like many birds, seabirds often migrate after the breeding season. Some species also undertake trans-equatorial trips, both from the north to the south, and from south to north (DoE 2020).

Other species migrate shorter distances away from the breeding sites, their distribution at sea determined by the availability of food. If oceanic conditions are unsuitable, seabirds will immigrate to more productive areas, sometimes permanently if the bird is young (Oro et al. 2004). After fledging, juvenile birds often disperse further than adults, and to different areas, so are commonly sighted far from a species' normal range. Some species, such as some of the petrels and cormorants, rarely disperse at all, staying near their breeding colonies year-round (DoE 2020).

10.4. Biologically Important Areas / Critical Habitat– Birds

Table 17 below provides an overview of BIAs in the EMBA for birds. The DCCEEW may make recovery plans for threated fauna listed under the EPBC Act. The EPBC Act requires that 'habitat critical to the survival of the listed threatened species' is identified in recovery plans, relevant recovery plans are listed in **Section 15.2**[4].

In addition, both the EPBC Act and WA BC Act and associated regulations (2018) provide for the listing of critical habitat - habitat 'critical to the survival of the threatened species. No provision is made under the TPWC Act for listing critical habitat.

[4] Further background information on BIA and identification of critical habitat in recovery plans is provided in Section 6.4.

Table 17: Critical habitat/ biologically important areas - birds

Species	Scientific name	Aggregation area and use	Specific geographic locations for species
Australian fairy tern	*Sternula nereis*	Foraging – lower north-west coast, west coast, south coast including islands. Breeding – Pilbara and Gascoyne coasts and islands	Found in the vicinity of lower north-west coast (north to Dampier Archipelago), west coast (south to Peel Inlet) and south coast (from Flinders Bay east to Israelite Bay), including islands (as far offshore as Trimouille Island and Houtman Abrolhos). Pilbara and Gascoyne coasts and islands
Lesser crested tern	*Sterna bengalensis*	Breeding, foraging - Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef
Roseate tern	*Sterna dougallii*	Breeding, foraging – Islands and coastline in the Kimberley, Pilbara and Gascoyne regions Resting – Eighty Mile Beach Foraging & provisioning young– North-western and west coasts and islands from Sir Graham Moore Is (13º50'S), south to Mandurah (32º32'S) and as far offshore as Ashmore Reef, Bedout Island and the Houtman Abrolhos.	Eighty Mile Beach (northern end) Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef North-western and west coasts and islands from Sir Graham Moore Is (13º50'S), south to Mandurah (32º32'S) and as far offshore as Ashmore Reef, Bedout Island and the Houtman Abrolhos.
Wedge-tailed shearwater	*Ardenna pacifica*	Breeding, foraging – west coast from Ashmore Reef to Carnac I. Kimberley, Pilbara, Gascoyne coasts, Ashmore reef	Breeding (in hundreds of thousands) off west coast from Ashmore Reef (12º15'S) to Carnac Island (32º07'S), and ranging in western seas between 12º00'S and 33º20'S. Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef

11. Protected Areas

A number of areas in the EMBA are protected under state and federal legislation. Protected areas include Wetlands of National Importance, National and Commonwealth Heritage Places, and terrestrial conservation reserves (National Parks, Nature Reserves and Conservation Parks) that bound marine waters. These areas are listed in **Table 18**, and shown in Figure 13.

, and discussed below. Other protected areas include Key Ecological Features, but none are present in the EMBA; and State and Commonwealth Marine Parks/Reserves (discussed in **Section 13** and **Section 14**). A Protected Matters search of the EMBA (Appendix D of the DC Gas Supply Pipeline EP) identified several protected areas which were deemed to be irrelevant to Santos' petroleum activities due to their terrestrial location (e.g. Forrestdale and Thomsons Lakes – Ramsar wetland).

The Register of the National Estate (RNE) provides a listing of more than 13,000 natural, historic and indigenous sites of significance. However, in 2012 all references to the RNE were removed from the EPBC Act and the *Australian Heritage Council Act 2003*.The RNE is now maintained on a non-statutory basis as a publicly available archive and educational resource. The RNE places are not discussed further here but are listed in Appendix D of the DC Gas Supply Pipeline EP.

Table 18: Summary of protected areas in waters within the EMBA

Area type	Title
Wetlands of National Importance	None in EMBA
National Heritage Place	Dampier Archipelago (including Burrup Peninsula) (Indigenous)
Commonwealth Heritage Place	None in EMBA
Terrestrial Conservation Reserves e.g. national parks, nature reserves, and conservation parks.	Numerous bounding marine waters – refer to **Section 11.2**.
World Heritage Places	None in EMBA

11.1. National Heritage Places

Natural, historic and indigenous places that are of outstanding heritage value to the Australian nation are recorded as National Heritage Places.

11.1.1. Dampier Archipelago (including Burrup Peninsula)

The Dampier Archipelago (including the Burrup Peninsula) contains one of the densest concentrations of rock engravings in Australia, with some sites containing thousands or tens of thousands of images. At a national level it has an exceptionally diverse and dynamic range of schematised human figures and provides an unusual and outstanding visual record of the Aboriginal responses to the rise of sea levels at the end of the last Ice Age (DoEE 2019c).

The site is about 36,860 ha at Dampier and comprises of nine distinct areas of the Burrup Peninsula Areas and part of the following surrounding islands: West Intercourse Island, West Mid Intercourse Island, Enderby Island, Goodwin Island, West Lewis Island and East Lewis Island, Rosemary Island, Brigadier Island, Miller Rocks, Lady Nora Island and Elphick Nob, Malus Islands, Angel Island, Gidley Island, Cohen Island, Keast Island and Collier Rocks, Tozer Island, Dolphin Island, and Unnamed Island (DoEE 2019c).

11.2. Coastal Terrestrial Conservations Reserves – bound by marine waters

Conservation reserves are created under the Land Administration Act 1997, and once reserved and set aside for conservation purposes are regulated under the *Conservation and Land Management Act (CALM) 1984*. Most conservation reserves in WA are vested in (owned) by the WA Conservation and Parks Commission, an independent statutory body established by the CALM Act 1984, and most are managed by the Department of Biodiversity, Conservation and Attractions – Parks and Wildlife Service.

In WA there are three main types of terrestrial conservation reserves with legislative protection:

- Nature reserves – established for wildlife and landscape conservation; scientific study; and preservation of features of archaeological, historic or scientific interest.
- National parks – as above but also to be used for enjoyment by the public. Have national or international significance.
- Conservation parks – as above but have local or regional significance.

Nature reserves can have an extra classification applied to them and become ‘A class’ reserves, which generally require an Act of Parliament to alter.

There are numerous terrestrial conservation reserves located adjacent to the coast in the EMBA. The oceanward boundary of the reserves varies. In some cases, the reserves extend to the low water mark, i.e. including the inter-tidal zone (particularly applicable to older gazetted reserves and terrestrial reserves not surrounded by a marine reserve). While in other cases, the terrestrial reserves extend to the high-water mark e.g. Lowendal Islands Nature Reserve (particularly applicable to terrestrial reserves adjacent to more recently gazetted marine parks). In other cases, the seaward boundary of the reserves is not defined. Management plans also contain the caveat for further consideration of the most appropriate tenure for intertidal areas and management arrangements.

11.2.1. Coastal Nature Reserves and Conservation Parks

Protected coastal nature reserves and conservation parks managed under the CALM Act 1984 in the EMBA are listed in **Table 19** and shown in,

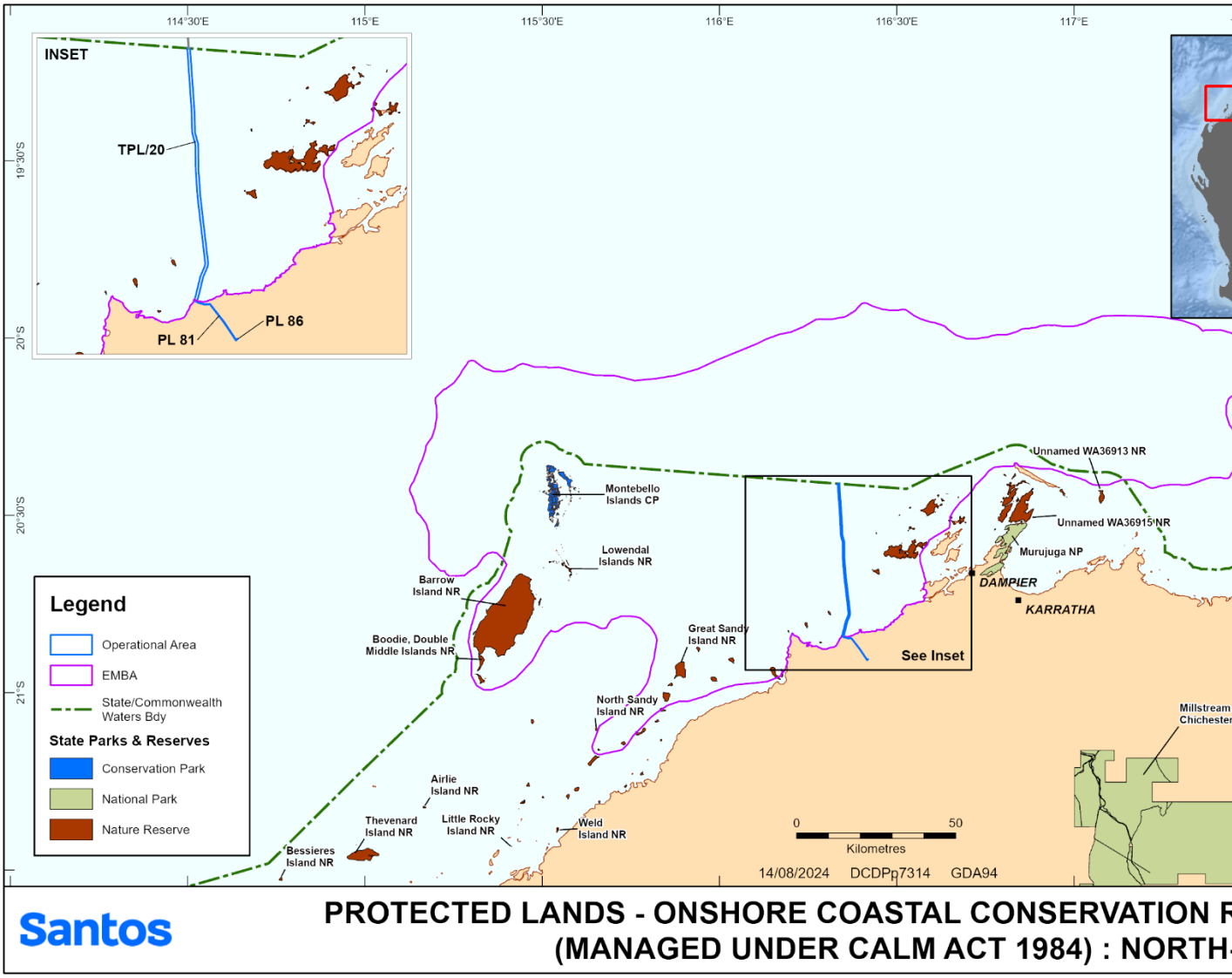


Figure 14. The table also includes reserve class; IUCN classification; any applicable management plan; whether the reserve includes the inter-tidal area; and the name of any adjacent state marine reserve (may also describe inter-tidal areas values).

The CALM Act does not require management plans to be in place for conservation reserves at all times, instead they are required to be made as is reasonably practicable regarding resources. This means some conservation reserves do not have a management plan, or do not have a recent management plan.

Table 19: Nature Reserves (NR), Conservation Parks (CP), Regional Parks (RP) and Coastal Reserves (CR) in the EMBA

Reserve name and type	Reserve class	IUCN	Management Plan	Includes inter-tidal zone	Adjacent Marine Park (see Section 13)
Reserves of north-west WA (see					

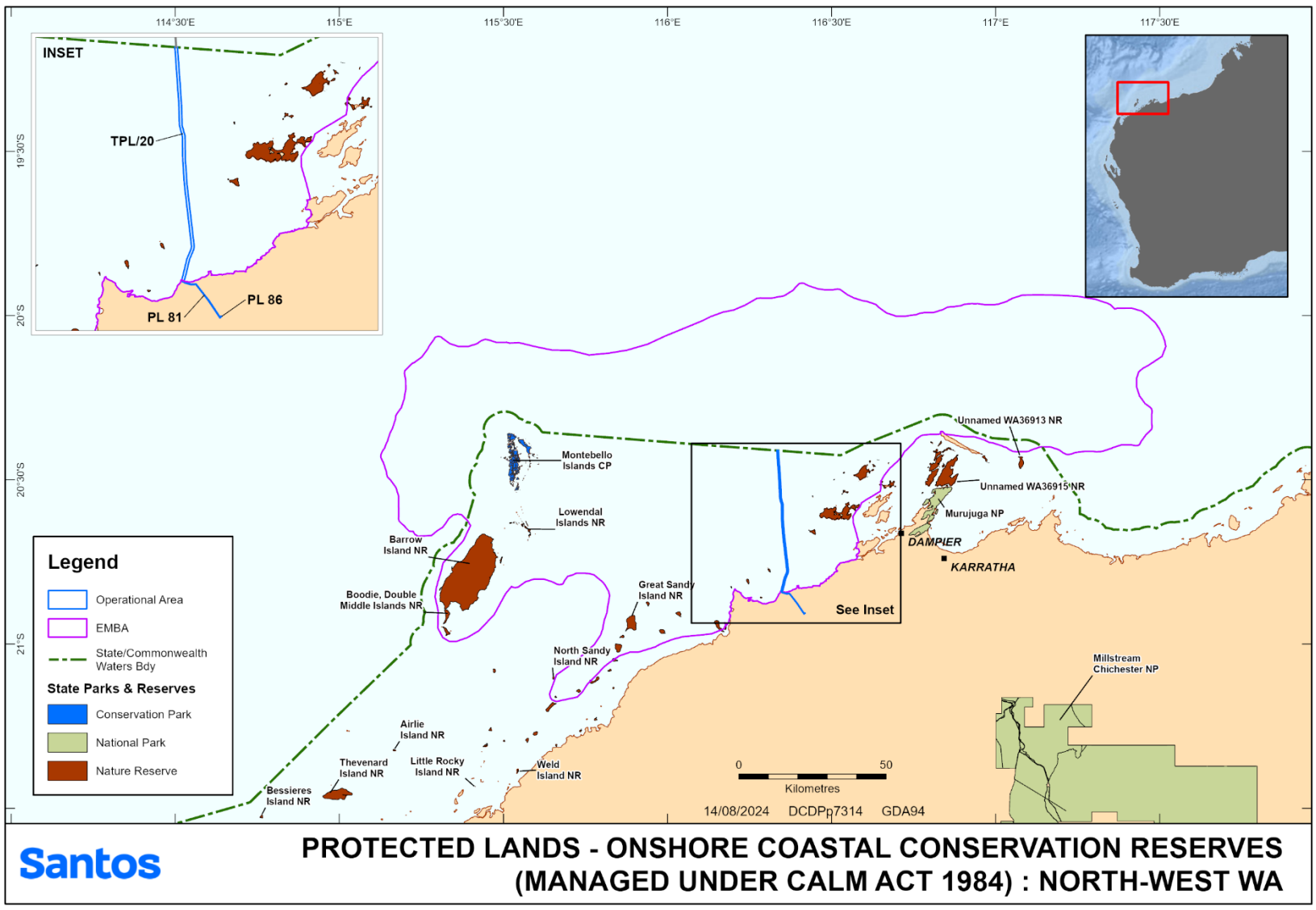


Figure 14**)**

Unnamed (Dampier Archipelago) NR	A	1a	Dampier Archipelago Management Plan (CALM 1990). *Covers 25 of the islands*	Yes	-
Unnamed NR (several)		1a	-	Yes [5]	-
North Sandy Island NR	A	1a	-	Yes [5]	-
Montebello Islands CP	A	2	-	Partially [6]	Montebello Islands Marine Park
Lowendal Island NR		1a	-	No	Barrow Island Marine Management Area and Marine Park. Lowendal Island NR only partially bounded
Barrow Island NR	A	1a	Barrow Island Group Nature Reserves (DPAW 2015)	Yes	
Boodie, Double and Middle Islands NR	-	1a		Yes	

[5] Conservatively inferred as no adjacent Marine Park.
[6] Reserve R42197 includes the inter-tidal zone and reserve R42196 does not.

Further information is provided below in relation to Varanus Island. Santos' Varanus Island Processing Hub co-exist with the reserve.

Lowendal Islands Nature Reserve - Varanus Island

Varanus Island is part of the Lowendal Islands group, a Nature Reserve (Class C). The Lowendal Islands comprise more than 40 limestone islands, islets and rocky stacks. There is not currently a DBCA Management Plan covering the Lowendal Islands Nature Reserve. Varanus Island is the largest island in the Lowendal Islands and is approximately 2.5 km long and 600m wide at its widest point. Its highest point is approximately 30m above sea level.

Described ecological conservation values of marine relevance include: wedge-tailed shearwater nesting (see **Section 10.1.5**); loggerhead and hawksbill turtle nesting (see **Section 7.1.1** and **Section 7.1.3**), flatback turtle nesting (**Section 7.1.4**). The Lowendal Islands are described as particularly important for tern breeding (DEC 2002), further information on terns is provided in **Section 10.1.5**.

11.3. Threatened Ecological Communities

An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. Ecological communities are listed under the EPBC Act as threatened if the community is at risk of extinction.

Similarly, ecological communities can be listed under the WA BC Act as threatened if facing a risk of becoming a collapsed ecological community. To date no ecological communities are listed as threatened under the WA Act, however several ecological communities are currently endorsed by the WA Minister of Environment as Threatened Ecological Communities (TECs) through the previous non-statutory process.

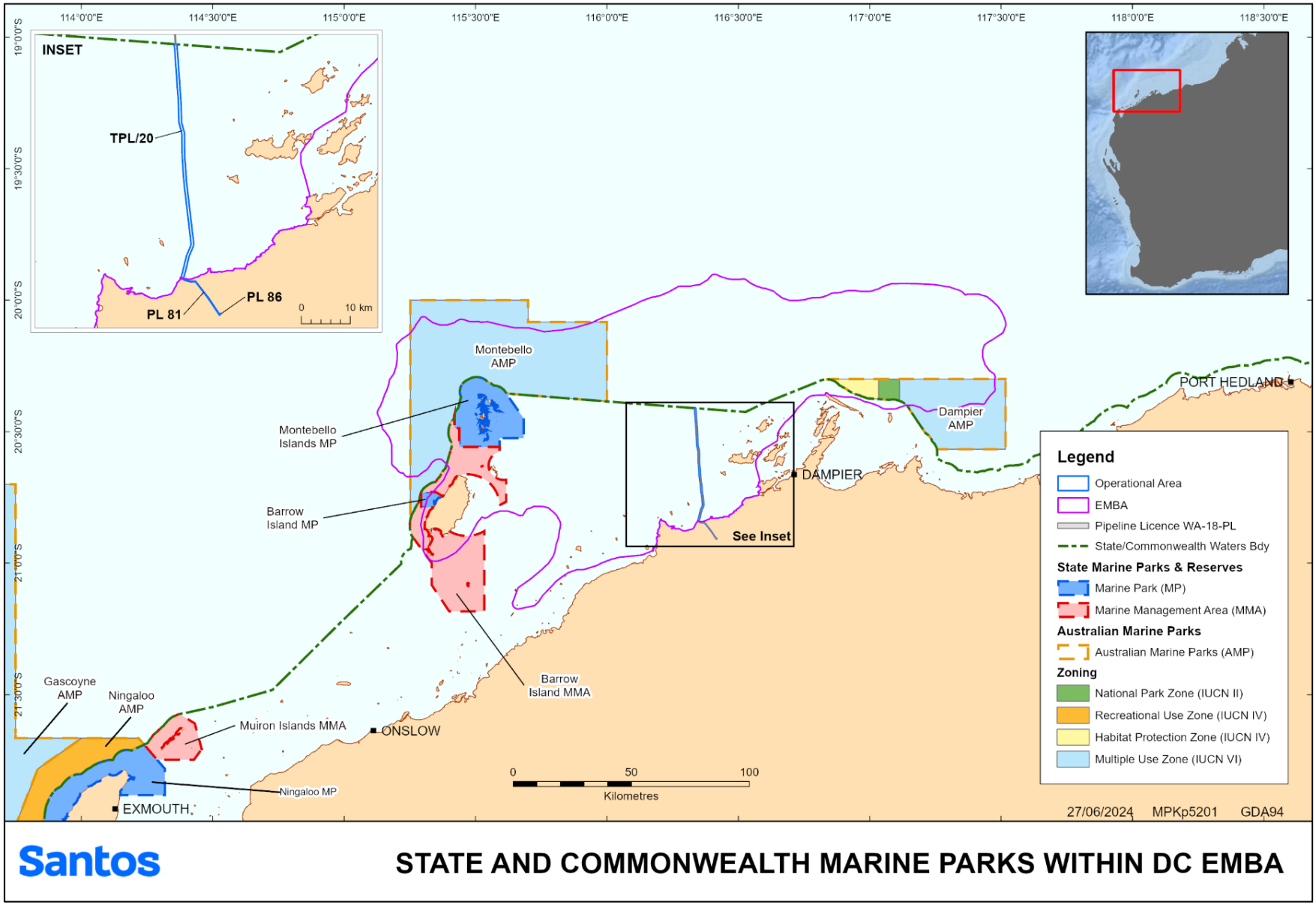


Figure 13: Protected areas in EMBA

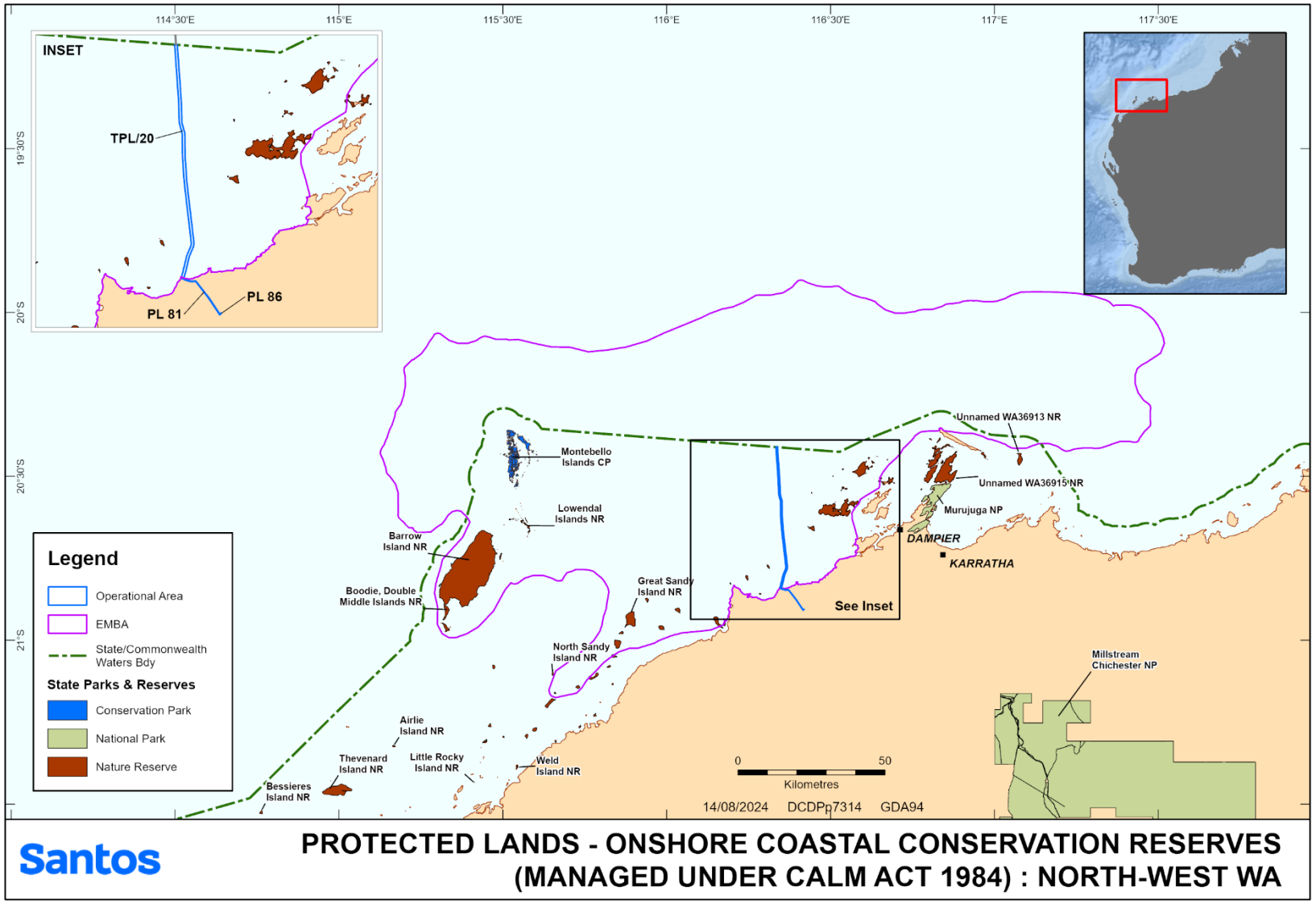


Figure 14: Protected Lands (CALM Act 1984) – terrestrial conservation reserves bounding marine waters in North-West WA

12. Key Ecological Features

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity. KEFs meet one or more of the following criteria (DSEWPaC 2012a):

- A species, group of species or a community with a regionally important ecological role
- A species, group of species or a community that is nationally or regionally important for biodiversity
- An area or habitat that is nationally or regionally important for:
  - Enhanced or high biological productivity
  - Aggregations of marine life; or
  - Biodiversity and/or endemism
- A unique sea floor feature with ecological properties of regional significance.

There are no KEFs in the EMBA.

13. State Marine Conservation Reserves

13.1. Introduction

Marine parks and reserves have been progressively established in Western Australia since 1987. The Conservation and Parks Commission (CPC) is the vesting authority for marine parks and reserves under the provisions of the *Conservation and Land Management Act 1984*. Parks and Wildlife, within the Department of Biodiversity, Conservation and Attractions (DBCA), is responsible for day-to-day management of the parks.

There are three categories of state marine conservation reserves: marine parks; marine management areas; and marine nature reserves.

Marine parks are created to protect natural features and aesthetic values while allowing recreational and commercial uses that do not compromise conservation values. There are currently3 State marine reserves wholly or partially within the EMBA (refer Figure 13).

Marine parks are multiple-use reserves that cater for a wide range of activities. Within marine parks there may be four types of management zones: recreation zones: general use zones; no-take areas known as sanctuary zones; and special purpose zones.

Each marine park has a ‘management plan’ that contains strategies to protect the high value assets in the park, as well as permitted activities tables. These tables provide explicit regulatory management.

Sanctuary zones are ‘no-take' areas created primarily for conservation and scientific research and are designed to protect a particular significant ecosystem or habitat. Low-impact tourism may be permitted, but no recreational or commercial fishing, aquaculture, pearling, petroleum drilling or production is allowed.

Marine management areas provide an integrated management structure over areas that have high conservation value and intensive multiple-use.

13.1.1. Barrow Island Marine Park

The Barrow Island Marine Park covers 4,169 ha, all of which is zoned as sanctuary zone (the Western Barrow Island Sanctuary Zone) (DEC 2007). It includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, an important turtle aggregation and breeding area (DEC 2007). Representative areas of seagrass, macroalgal and deep-water habitat are also represented within the marine park (DEC 2007). Passive recreational activities (such as snorkelling, diving and boating) are permitted but extractive activities such as fishing and hunting are not.

Barrow Island marine park is located wholly within the EMBA.

13.1.2. Barrow Island Marine Management Area

The Barrow Island MMAis the largest reserve within the Montebello/ Barrow Islands marine conservation reserves, covering 114,693 ha (DEC 2007). The MMA includes most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park, with the exclusion of the port areas of Barrow Island and Varanus Island.

The MMA is not zoned apart from one specific management zone: the Bandicoot Bay Conservation Area. This conservation area is on the southern coast of Barrow Island and has been created to protect benthic fauna and seabirds. It includes the largest intertidal sand/mudflat community in the reserves, is known to be high in invertebrate diversity and is an important feeding area for migratory birds.

As for the other reserves in the Montebello/Barrow Islands marine conservation reserves, the Barrow Island MMA includes significant breeding and nesting areas for marine turtles and the waters support a diversity of tropical marine fauna, important coral reefs and unique mangrove communities (DEC 2007). Green, hawksbill and flatback turtles regularly use the island’s beaches for breeding, and loggerhead turtles are also occasionally sighted.

Barrow Island MMA is located wholly within the EMBA.

13.1.3. Montebello Islands Marine Park

Montebello/ Barrow/ Lowendal Islands are part of a shallow submarine ridge, which extends north from the mainland near Onslow. The ridge contains extensive areas of intertidal and shallow subtidal limestone pavement

surrounding the numerous, mostly small islands which are found in the region. The seabed is generally less than 5 m deep and consists of sand veneered limestone pavement with patches of fringing coral reef (DEC 2007).

The island chain lies entirely within WA State waters, with the State-Commonwealth boundary extending out to encompass the islands and waters 3 nm west of Barrow Island and north of the Montebello Islands. These islands are protected within as marine conservation reserves: Montebello Islands Marine Park, Barrow Islands Marine Park and Barrow Island Marine Management Area.

The Montebello Islands Marine Park (58,331 ha) consists of two sanctuary zones, two recreation zones, one special purpose zone for benthic protection, 11 special purpose zones for pearling and general use zones.

The Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops; rocky shore accounts for 81 % of shoreline habitat (DEC 2007a).

The ecological and conservation values of the Montebello and Barrow Islands Marine Conservation Reserve (MCR) include important habitats including corals reefs and bommies, mangroves, seagrass and macroalgae meadows, rocky shorelines and hard substrate, intertidal sand and mudflat communities. These habitats provide protection, food and habitat for a large diversity of species, including dugongs, turtles, whales, other protected cetaceans and birds as well as sea snakes and fish. The area is considered to have a high biodiversity. The islands also provide feeding and resting areas for migrating shorebirds and seabird nesting areas.

Socio-economic values of the Montebello and Barrow Islands MCR include hydrocarbon exploration and production, pearling, nature-based tourism, commercial and recreational fishing, water sports, European history and maritime heritage and scientific research (DEC 2007).

Special purpose zones for pearling are established for the existing leaseholder to allow pearling to be the priority use of these areas (DEC 2007a). Commercial fishing includes a trap fishery for reef fishes, mainly in water depths of 30–100 m, and wet lining for reef fish and mackerel. Fish trawling also occurs in the waters near to the Montebello Islands. A tourist houseboat operates out of Claret Bay, at the southern end of Hermite Island, during the winter months. The Montebello Islands are becoming more frequently used by recreational boaters for camping, fishing and diving activities.

Montebello Islands marine park is located wholly within the EMBA.

14. Australian Marine Parks

14.1. Introduction

In agreement with the states and NT governments, the Australian Commonwealth government committed to establish Commonwealth marine parks as a component of the National Representative System of Marine Protected Areas (DoE 2014) (See Figure 13). 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 (Director of National Parks 2012a). Commonwealth Marine Reserves were renamed as Australian Marine Parks in October 2017. Seven marine regions are included in the Australian Marine Parks Network, including the Coral Sea, the South-west, the Temperate East, the South-east, the North, the North-west and Indian Ocean Marine Territories. The North-west network 10-year Management Plan came into effect on 1 July 2018. The new management plans establish the management and zoning of the designated marine parks. The marine park networks pertinent (i.e. marine parks wholly or partially within the EMBA) to the EMBA include the:

- North-West Marine Parks Network

The North-West Marine Parks Network comprises 13 marine parks of which two occur in the EMBA:

- Montebello Marine Park (partially within the EMBA)
- Dampier Marine Park (partially within the EMBA)

The EPBC Act requires that each management plan assign an International Union for the Conservation of Nature (IUCN) category to each marine park. Additionally, the Act also allows for the management plan to divide a marine park into zones and to assign a category to each zone, which may differ from the overall category of the marine park. Zoning considers the purposes for which the marine parks were declared, the objectives of the relevant management plans, the values of the marine park and requirements of the EPBC Act and EPBC Regulations.

The North-West Marine Parks Network includes six different types of zoning:

- Sanctuary Zone (IUCN Category Ia)
- National Park Zone (IUCN Category II)

- Recreational Use Zone (IUCN Category IV)
- Habitat Protection Zone (IUCN Category IV)
- Multiple Use Zone (IUCN Category VI)
- Special Purpose Zone (Trawl) (VI).

14.2. North-West Marine Park Network

The North-West Marine Parks Network is aligned to the North-west Marine Region. The network covers 335, 341 km^2 and includes 13 marine parks (Director of National Parks, 2018b). Broad values of the North-west Commonwealth Marine Reserves Network include:

- Natural values
- Cultural values
- Heritage values
- Socio-economic values.

Further detail on each of the relevant marine parks within the EMBA is provided below. See **Section 14.1** for extent of marine parks partially within the EMBA.

14.2.1. Montebello Marine Park

The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western Australian state water boundary and is adjacent to the Western Australian Barrow Island and Montebello Islands Marine Parks. The Montebello Marine Park (Multiple Use Zone – IUCN Category VI) covers an area of approximately 3,413 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas for migratory seabirds that are adjacent to important breeding areas
- Areas used by vulnerable and migratory whale sharks for foraging
- Foraging areas marine turtles which are adjacent to important nesting sites
- Section of the north and south bound migratory pathway of the humpback whale
- Shallow shelf environments with depths ranging from 15–150 m which provides protection for shelf and slope habitats, as well as pinnacle and terrace sea floor features
- Sea floor habitats and communities of the Northwest Shelf Province provincial bioregions as well as the Pilbara (offshore) meso-scale bioregion
- One KEF for the region is the ancient Coastline (a unique sea floor feature that provides areas of enhanced biological productivity).

Commercial tourism, commercial fishing, mining and recreation are important socio-economic values for the park.

14.2.2. Dampier Marine Park

The Dampier Marine Park (Marine National Park Zone – IUCN Category I-73 km^2; Habitat Protection Zone – IUCN Category IV-104 km^2; Multiple Purpose Zone – IUCN Category VI-1,074 km^2) covers an area of approximately 1,252 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas for migratory seabirds that are adjacent to important breeding grounds
- Important foraging areas for marine turtles adjacent to significant nesting sites
- Part of the migratory pathway of the protected humpback whale
- Protection for offshore shelf habitats and shallow shelf habitats adjacent to the Dampier Archipelago
- Communities and sea floor habitats of the Northwest Shelf Province provincial bioregion as well as the Pilbara (nearshore) and Pilbara (offshore) meso-scale bioregions are included.

Port activities, commercial fishing and recreation (e.g. fishing) are important activities in the marine park (Director of National Parks 2018b). No heritage listings apply to the marine park.

15. Conservation Management Plans

In order to protect, maintain and enhance recovery of certain threatened species and ecological communities the DAWE may prepare conservation management plans in the form of Conservation Advice or Recovery Plans.

15.1. Conservation Advice

When a native species or ecological community is listed as threatened under the EPBC Act, conservation advice is developed to assist its recovery. Conservation advice provides guidance on immediate recovery and threat abatement activities that can be undertaken to ensure the conservation of a newly listed species or ecological community.

15.2. Recovery Plans

The Australian Government Minister for the Environment may make or adopt and implement recovery plans for threatened fauna, threatened flora (other than conservation dependent species) and threatened ecological communities listed under the Commonwealth EPBC Act. Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community (DCCEEW, 2024).

Table 22: Summary of EPBC Act recovery plans applicable to the EMBA

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
Marine Mammals		
Blue whale	Blue Whale Conservation Management Plan 2015-2025 (2015) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) Guidance on key terms within the Blue Whale Conservation Management Plan (Department of Agriculture, Water, and the Environment, 2021)	Noise interference
		Habitat modification
		Climate variability and change
		Vessel disturbance
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (2015) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Anthropogenic noise and acoustic disturbance
		Climate variability and change
		Pollution (persistent toxic pollutants)
		Vessel strike
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (2015) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Anthropogenic noise and acoustic disturbance
		Climate variability and change
		Habitat degradation including pollution (persistent toxic pollutants)
		Marine debris
		Vessel strike
Humpback whale	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Noise interference
		Habitat degradation including coastal development and port expansion or drilling infrastructure
		Marine debris
		Vessel strike
Southern right whale	Conservation Management Plan for the Southern Right Whale 2011 – 2021 (2012) National Recovery Plan for Southern Right Whale 2024	Anthropogenic climate change and climate variability
		Anthropogenic underwater noise
		Collision/vessel strike
		Pollution

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
Marine Reptiles		
Short-nosed seasnake	Approved Conservation Advice for *Aipysurus apraefrontalis* (short-nosed seasnake) (2011)	Degradation of reef habitat
Leaf-scaled seasnake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (2011)	Habitat degradation
Loggerhead turtle	Recovery plan for marine turtles in Australia 2017-2027 (2017) Loggerhead turtle – WA genetic stock Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Noise interference
		Marine debris
		Deteriorating water quality
		Vessel disturbance
		Climate variability and change
		Light pollution
Green turtle	Recovery plan for marine turtles in Australia 2017-2027 (2017) Green turtle – NWS genetic stock (NWS), Scott-Browse genetic stock (ScBr), Ashmore genetic stock (AR) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Noise interference
		Deteriorating water quality
		Marine debris
		Vessel disturbance
		Climate variability and change
		Light pollution
Leatherback turtle, leathery turtle	Approved Conservation Advice for *Dermochelys coriacea* (2008)	Boat strike
		Changes to breeding sites
		Marine debris
	Recovery plan for marine turtles in Australia 2017-2027 (2017) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Noise interference
		Deteriorating water quality
		Marine debris
		Loss of habitat
		Climate variability and change
		Vessel disturbance
		Light pollution
Hawksbill turtle	Recovery plan for marine turtles in Australia 2017-2027 (2017)	Noise interference

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
	Hawksbill turtle – WA genetic stock Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Deteriorating water quality
		Marine debris
		Loss of habitat
		Climate variability and change
		Vessel disturbance
		Light pollution
Flatback turtle	Recovery plan for marine turtles in Australia 2017-2027 (2017) Flatback turtle – Pilbara coast genetic stock (Pil), South-west Kimberley coast genetic stock (swKim) and Cape Domett (CD) Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2023)	Noise interference
		Deteriorating water quality
		Marine debris
		Loss of habitat
		Climate variability and change
		Vessel disturbance
		Light pollution
Fish and Sharks		
Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015)	Marine debris
		Habitat disruption from mineral exploration, production and transportation
		Climate change
		Boat strike from large vessel
Grey nurse shark (west coast population)	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (2014)	Ecosystem effects as a result of habitat modification and pollution effects
	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans (2018)	Marine debris
Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (2013)	Ecosystem effects as a result of habitat modification
Dwarf sawfish	Approved Conservation Advice on *Pristis clavata* (dwarf sawfish) (2009)	Habitat degradation and modification
	Sawfish and River Sharks Multispecies Recovery Plan (2015)	

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
Green sawfish	Approved Conservation Advice on *Pristis zijsron* (green sawfish) (2008)	Habitat degradation and modification
	Sawfish and River Sharks Multispecies Recovery Plan (2015)	
Freshwater sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (2014)	Habitat degradation and modification
	Sawfish and River Sharks Multispecies Recovery Plan (2015)	
Blind Cave-Eel	Approved Conservation Advice for *Ophisternon candidum* (Blind Cave Eel) (2008)	Sedimentation from mining and construction, canal development, water abstraction, point source pollution from sewage, landfill, dumping and mining; and diffuse pollution from urban development.
Birds		
All seabirds and shorebirds	National Light Pollution Guidelines for Wildlife (DCCEEW 2023)	Habitat modification
		Climate change and variability
		Light pollution
Seabirds	Wildlife Conservation Plan for Seabirds (CoA 2020)	Anthropogenic disturbance
		Climate change
		Invasive species
		Pollution (marine debris, light, water)
		Habitat loss or modification
Sharp-tailed Sandpiper	Conservation advice for Calidris acuminata (sharp-tailed sandpiper) (DCCEEW 2024b) Wildlife Conservation Plan for Migratory Shorebirds (CoA 2015)	Climate change
		Chronic and acute pollution
Red knot	Approved Conservation Advice for *Calidris canutus* (red knot) (2024) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation
		Climate change
		Pollution/contamination impacts

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
Southern giant-petrel	National Recovery Plan for Albatrosses and Petrels (2022) Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened Under the EPBC Act (2011)	Marine pollution
		Climate change
		Marine debris
Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (curlew sandpiper) (2023)	Habitat loss and degradation from pollution
Greater sand plover	Approved Advice for *Charadrius leschenaultia* (greater sand plover) (2023) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation
		Climate variability and change
		Pollutant/contaminant impacts
Red goshawk	Conservation Advice for *Erythrotriorchis radiatus* (red goshawk) (2023)	Climate variability and change
Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (eastern curlew) (2023)	Habitat loss and degradation from pollution
Bar-tailed godwit	Approved Conservation Advice for *Limosa lapponica baueri* (bar-tailed godwit western Alaskan) (2024) Wildlife Conservation Plan for Migratory Shorebirds (2015)	Habitat loss and degradation from pollution
		Pollution/contamination impacts
Northern Siberian bar-tailed godwit	Approved Conservation Advice for *Limosa lapponica menzbieri* (bar-tailed godwit northern Siberian) (2024)	Habitat loss and degradation from pollution
		Pollution/contamination impacts
Australian fairy tern	Commonwealth Conservation Advice on *Sternula nereis nereis* (fairy tern) (2011) National Recovery Plan for the Australian Fairy Tern (Sternula nereis nereis) (2020)	Oil spills
		Habitat loss, disturbance and modifications
		Climate variability and change
White-winged fairy wren	Approved Conservation Advice for *Malurus leucopterus edouardi* (white-winged fairy-wren (Barrow Island))	Habitat loss, disturbance and modification
Night parrot	Conservation Advice *Pezoporus occidentalis* night parrot (2016)	Habitat loss, disturbance and modification

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
Red-tailed tropicbird	Conservation Advice for Phaethon rubricauda westralis (Indian Ocean red-tailed tropicbird).(2023) Wildlife Conservation Plan for Migratory Seabirds (2020)	Climate variability and change
Australian painted snipe	Commonwealth Conservation Advice for *Rostratula australis* (Australian painted snipe) (2013) National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (2022a)	Habitat loss, disturbance and modification
Terrestrial mammals and reptiles		
Northern quoll	National Recovery Plan For the Northern Quoll *Dasyurus hallucatus* (2010)	Habitat degradation
Ghost bat	Conservation Advice for *Macroderma gigas* (Ghost bat) (2016)	Modification to foraging habitat
Pilbara leaf nosed bat	Conservation advice for *Rhinonicteris aurantia (Pilbara form)* (Pilbara leaf-nosed bat) (2016)	Forced exodus of roost sites Interruption of breeding activity
Golden bandicoot (Barrow Island)	Approved Conservation Advice for *Isoodon auratus barrowensis* (golden bandicoot (Barrow Island)) (2014)	
Spectacled hare-wallaby (Barrow Island)	Approved Conservation Advice for *Lagorchestes conspicillatus conspicillatus* (Spectacled Hare-wallaby (Barrow Island)) (2008)	Habitat degradation
Mala, rufous hare-wallaby (Central Australia)	Conservation Advice for *Lagorchestes hirsutus* (Central Australian subspecies (Mala) (2023) National Recovery Plan for the Rufous Hare-wallaby (*Lagorchestes hirsutus*) (2012)	Climate change
Barrow Island wallaroo, Barrow Island euro	Approved Conservation Advice for *Macropus robustus isabellinus* (Barrow Island Euro) (2008)	Habitat degradation associated with development of petroleum infrastructure on Barrow Island
Black-flanked rock-wallaby	Conservation Advice for *Petrogale lateralis lateralis* (Black-flanked rock-wallaby) (2016) Recovery plan for five species of rock wallabies: Black-footed rock wallaby (*Petrogale lateralis), Rothschild rock wallaby (Petrogale rothschildi),* Short-eared rock wallaby *(Petrogale brachyotis),*	Drying climate due to climate change

Name	Recovery Plan/Conservation Advice/Management Plan	Threats and Strategies Identified as Relevant to the Activity
	Monjon *(Petrogale burbidgei*) and Nabarlek (*Petrogale concinna*) 2012-2022 (2013)	
Boodie, burrowing bettong	Conservation Advice for *Bettongia lesueur lesueur* (burrowing bettong (Shark Bay)), and *Bettongia lesueur* Barrow and Boodie Islands subspecies (burrowing bettong (Barrow and Boodie Islands)) (2023) National recovery plan for the Western Barred Bandicoot *(Perameles bougainville)*, Burrowing Bettong *(Bettongia lesueur)* and Banded Hare-Wallaby *(Lagostrophus fasciatus)* (2012)	Habitat modification - reduction Climate change
Pilbara olive python	Approved Conservation Advice for *Liasis olivaceus barroni* (Olive Python - Pilbara subspecies) (2008)	Destruction of habitat due to gas and mining development (especially on Burrup Peninsula)
Hamelin ctenotus	Approved Conservation Advice for *Ctenotus zastictus* (Hamelin Ctenotus) (2008)	

16. Social and Economic Features

16.1. Industry

In 2020/21, Western Australia's petroleum industry was worth $23 billion. The petroleum sector accounted for 10.4 % of the total value of WA's mineral and petroleum sales in 2020/21, with 7.5 % of all mineral and petroleum sales coming from Liquefied Natural Gas (LNG). This is a 37% decrease in prices compared to 2018/19. The decrease was accounted for by a drop in oil prices due to excess supply from the COVID-19 pandemic and related economic shutdowns, operation issues at Gorgon, Prelude remaining offline until January 2021 along with maintenance shutdowns at the North West Shelf and Wheatstone. Currently Western Australia has five operating LNG projects; the North West Shelf, Gorgon, Pluto, Wheatstone and Prelude. There are also a number of Floating Production and Storage Offtake (FPSO) facilities in the Timor Sea and North West Shelf.

To the northeast of the DCGP, approximately 30 km along the North West Coastal Highway, is a mini liquefied natural gas processing plant operated by Energy Development Limited. Cape Preston, located approximately 20 km northwest of the DCGP, is also the proposed site for several mining and industrial developments.

The surrounding waters are also used extensively for petroleum exploration and development. The DC supply pipelines passes approximately 29 km to the north of the Stag Production Facility operated by Jadestone Energy. In addition, Wandoo Production Platforms are located in Exploration Permit WA-14-L, within the region.

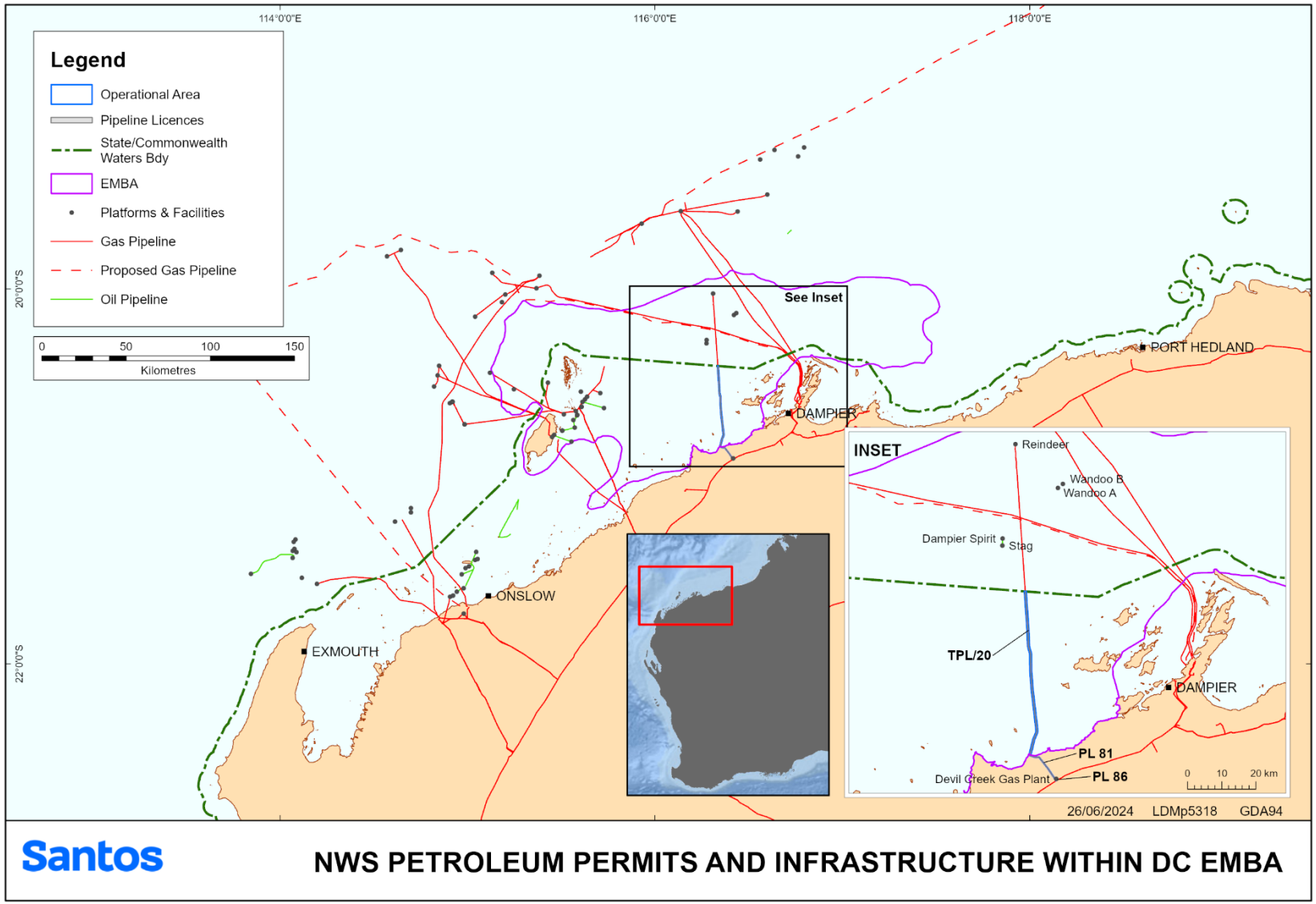


Figure 15: Existing petroleum infrastructure, permits and licences within DC EMBA

16.2. Shipping

The Western Australian coastline supports twelve ports including the major ports of Dampier, Port Hedland and Broome which are operated by their respective port authorities. Large cargo vessels move through the region to and from Fremantle, transiting along coastline. Commercial shipping also moves to and from marine terminals associated with the oil and gas industry (see **Section 16.1**). Other large ports include Geraldton, Busselton, Albany and Esperance. Closer proximity shipping also includes construction vessels/barges/dredges, domestic support vessels, and offshore survey vessels.

The Australian Maritime Safety Authority (AMSA) has established a network of shipping fairways off the north-west coast of Australia to manage traffic patterns (AMSA 2013). The Shipping Fairways are designed to keep shipping traffic away from offshore infrastructure and aims to reduce the risk of collision (AMSA 2013).

Use of the fairways is strongly recommended but not mandatory. The International Regulations for *Preventing Collisions at Sea 1972* apply to all vessels navigating within or outside the shipping fairways. The use of these fairways does not give vessels any special right of way (AMSA 2012).

Under the *Commonwealth Navigation Act 2012*, certain vessels operating in Australian waters are required to report their location on a daily basis to the Rescue Coordination Centre (RCC) in Canberra. This Australian Ship Reporting System (AUSREP) is an integral part of the Australian Maritime Search and Rescue system and is operated by AMSA through the RCC. Vessels recorded in waters in the EMBA through the AUSREP system in 2023 are shown in Figure 16.

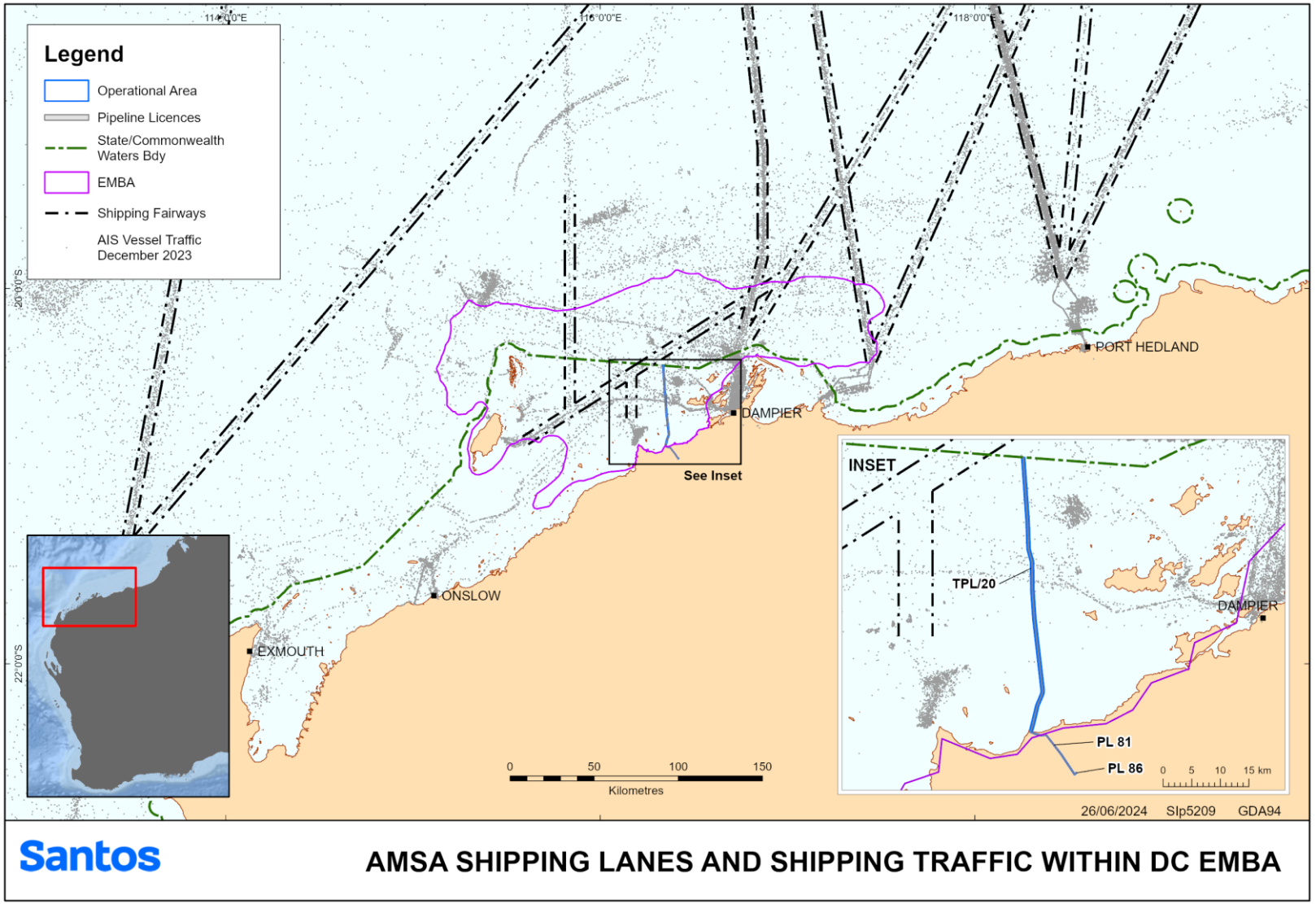


Figure 16: AMSA ship locations and shipping routes

16.3. Defence Activities

The Naval Communication Station Harold E. Holt is located on the northwest coast of Australia, 6 km north of Exmouth. The town of Exmouth was built at the same time as the communications station to provide support to the base and to house dependent families of US Navy personnel (Shire of Exmouth 2018, DoE 2014).

The station provides very low frequency radio transmission to US Navy and Royal Australian Navy ships and submarines in the western Pacific Ocean and eastern Indian Ocean. With a transmission power of 1 megawatt, it is the most powerful transmission station in the southern hemisphere (Shire of Exmouth 2018, DoE 2014).

Two Royal Australian Airforce (RAAF) bases are located in the northwest of WA; Learmonth RAAF Base, near Exmouth and Curtin RAAF Base near Derby (RAAF 2014), both outside of the EMBA.

Designated military exercise areas occur over waters and airspace of the north west of WA and may be activated following the required notifications. The Learmonth air weapons range is approximately 150km from the EMBA, but the exercise area overlaps the EMBA.

16.4. Tourism

The Pilbara and Gascoyne regions are popular visitor destination for Australian and international tourists. Tourism is concentrated in the vicinity of population centres including Dampier, Exmouth, Coral Bay and Shark Bay.

Marine tourism to offshore Islands includes various Pilbara nearshore Islands (Muiron, Serrurier, Sholl and Montebello). The Montebello Islands are ranked among the world's most bio-diverse marine environments (DBCA) and are attracting a growing number of nature-based tourism operators, with people participating in activities such as fishing, diving, wildlife viewing, island exploration and surfing (DEC 2007).

Tourism contributes to local economies in terms of both income and employment and tourists include local, interstate and international visitors. Popular water-based activities include fishing, swimming, snorkelling/ diving, surfing/windsurfing/kiting and boating, while popular land-based activities include bushwalking, camping, bird watching and four-wheel driving.

16.5. Maritime Heritage

Details of recorded shipwreck sites are available on the Australian National Shipwreck Database are managed by the DCCEEW although precise locations of the wrecks are sometimes unknown. There are no listed World Heritage areas, Aboriginal heritage, cultural heritage places or records of shipwrecks within or in the vicinity of the operational area. The closest known shipwreck to the operational area is the Dampier shipwreck, located approximately 16 km southwest of the operational area.

Within the EMBA, there are no shipwrecks known to be in excess of 75 years old as of March 2024.

Under the Commonwealth *Underwater Culture Heritage Act 2018* all shipwrecks older than 75 years are protected, while those dated pre-1900 are protected by WA law under the Maritime Archaeology Act 1973.

Submerged archaeological landscapes have recently been identified in WA through combined evidence of terrestrial ecology, coastal and marine geomorphology and sea-level studies (Benjamin et al 2020; McCarthy et al 2022). There is a potential for the existence of submerged landscapes with associated Aboriginal heritage values due to strong cultural connections between Traditional Owners and the sea (McCarthy et al 2022).

16.6. Commercial Fisheries

A valuable and diverse commercial fishing industry is supported by both the offshore and coastal waters in the Gascoyne and West Coast Bioregions between the WA and NT. The major fisheries in this area target tropical finfish, large pelagic fish species, crustaceans (prawns and scampi), Western Rock Lobster and pearl oysters (Fletcher and Santoro 2013). A number of smaller fisheries also exist in this area including the octopus and beche-de-mer fisheries.

16.6.1. State Fisheries

State fisheries are managed by the WA Department of Primary Industries and Regional Development (DPIRD) (formerly Department of Fisheries (DoF)) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the *Fish Resources Management Act 1994* (WA). The information on State managed fisheries has been derived from '*The State of the Fisheries'* Report 20 (Newman et al. 2023) and direct consultation with DPIRD. Santos consults regularly with State fisheries relevant to activity operational areas, mainly by distribution of an Annual Consultation Update by post (as well as conducting further consultation in

preparing an EP under s 25 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023.

State commercial fisheries that exist within the EMBA are shown in Figure 17 and Figure 18.. A summary of all commercial fisheries wholly or partially operating in the EMBA is also provided in **Table 20**. These are:

State Managed

- Pearl Oyster Managed Fishery
- Onslow Prawn Limited Entry Fishery
- Mackerel Managed Fishery (Area 2)
- Pilbara Demersal Scalefish Fisheries (includes trap and trawl fisheries)
- Pilbara Line Fishery
- Pilbara Crab Managed Fishery
- Nickol Bay Prawn Managed Fishery

Whole of State Fisheries

- Marine Aquarium Fish Fishery
- Specimen Shell Managed Fishery
- West Coast Deep Sea Crustacean Managed Fishery
- South West Coast Salmon Fishery
- Abalone Managed Fishery
- West Australian Sea Cucumber Fishery
- Hermit Crab Fishery.

Some of the fisheries listed above will be more susceptible to impacts than others, particularly fisheries without the ability to escape impacts. For example, above average water temperatures over the last three years will have had an impact on prawn fisheries in Exmouth and scallops and blue swimmer crabs in Shark Bay which have been significantly affected by the initial heat wave event of 2010/11 (Caputi et al. 2014).

16.6.2. Commonwealth Fisheries

Commonwealth fisheries are those within the 200 nautical mile Australian Fishing Zone (AFZ) managed by Australian Fisheries Management Authority (AFMA) and are, on the high seas, and, in some cases, by agreement with the States and Territory, to the low water mark. Information on Commonwealth managed fisheries has been derived from '*Fishery Status'* Report 2019 (Department of Agriculture 2019)

Commonwealth fisheries who have permits to operate in the EMBA include those shown in Figure 19 and summarised in **Table 20**:

- Southern Bluefin Tuna Fishery (SBFTF)
- Western Tuna and Billfish Fishery (WTBF) (including Southern Tuna and Billfish Fishery)

Skipjack Tuna Fishery (STF) (referred to as Western Skipjack Tuna Fishery in Figure 19.

Table 20: Commercial fisheries with permits to operate within the EMBA

Fishery	Target Species	Catch1	Fishing Method	Area Description
State Managed Fisheries				
Abalone Managed Fishery	Greenlip abalone (*Haliotis laevigata*) Brownlip abalone (*H. conicopora*)	2017/2018: 98 tonnes 2022/2023: Commercial: 40.1t Recreational: 11.6-17.2t	Dive fishery The principal harvest method is a diver working off 'hookah' (surface supplied breathing	Shallow coastal waters off the south-west and south coasts of Western Australia Covers all Western Australian coastal waters, which are divided into eight management areas. Commercial fishing for greenlip/brownlip abalone is managed in three separate areas.

Fishery	Target Species	Catch1	Fishing Method	Area Description
			apparatus) or SCUBA using an abalone 'iron' to prise the shellfish off rocks – both commercial and recreational divers employ this method.	Partially within the combined EMBA
Hermit Crab Fishery (HCF)	Australian land hermit crab (*Coenobita variabilis*)	2017/2018: 58,643 (lowest reported in the last 10 years (2008-2017; catch range 58,643-118,203). 2022 insufficient information	Land based hand collection typically using four-wheel drives to access remote beaches	Operates in Western Australian waters north of the Exmouth Gulf (22°30'S)
Marine Aquarium Fish Managed Fishery (MAFMF)	Over 250 target species of finfish. (228 species caught in 2012). Fishers can also take coral, live rock, algae, seagrass and invertebrates. The main fish species landed in 2012 were scribbled angelfish (*Chaetodontoplus duboulayi*) and green chromis (*Chromis cinerascens*) The main coral species landed in 2012 were the coral like anemones of the *Corallimorpharia*.	2017/2018: Total catch of 150,544 fishes, 21.9 t of coral, live rock & living sand and 322 L of marine plants. 2022: Commercial: total catch 19,710 individuals (fish) 77,287 invertebrates	Hand harvest while diving or wading. Hand held nets	Dive based fishery operating all year throughout WA waters but restricted by diving depths. The MAFMF is able to operate in all State waters (between the Northern Territory border and South Australian border). The fishery is typically more active in waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth and Dampier. Operators in the MAFMF are also permitted to take coral, live rock, algae, seagrass and invertebrates under the Prohibition on Fishing (Coral, 'Live Rock' and Algae) Order 2007 and by way of Ministerial Exemption (Gaughan & Santoro, 2018). Partially within the EMBA
Nickol Bay Prawn Managed Fishery (NBPMF)	Primarily targets banana prawns (*Penaeus merguiensis*)	2017/2018: 227 t 2022/2023: Commercial: 51 t	Otter trawl	Operates along the western part of the North-West Shelf in coastal shallow waters The boundaries of the NBPMF are 'all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200 m isobath'. The NBPMF incorporates the Nickol Bay, Extended Nickol Bay, Depuch and De Grey size managed fish grounds (State of the Fisheries 2014-15). Wholly within the EMBA
Onslow Prawn Managed Fishery (OPMF)	Western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.)	2017/2018: Negligible (Minimal fishing occurred in 2017) 2022/2023: Commercial: <60 t	Otter trawl	Operates along the western part of the North-West Shelf with most prawning activities concentrated in the shallower water off the mainland. The boundaries of the OPMF are 'all the Western Australian waters between the Exmouth Prawn

Fishery	Target Species	Catch1	Fishing Method	Area Description
				Fishery and the Nickol Bay prawn fishery east of 114º39.9' on the landward side of the 200 m depth isobath'. Wholly within the EMBA
Pilbara Developmental Crab Fishery	Blue Swimmer (*Portunus armatus*) Mud Crab (*Scylla* spp)	2017/2018: 60 t (total number includes Kimberley Developing Mud Crab Fishery) 2022/2023: unspecified	Variety of gear but mostly commercial crab pots (Hourglass traps used in inshore waters from Onslow through to Port Hedland with most commercial and activity occurring in and around Nickol Bay) Recreational fishers use drop nets or scoop nets, with diving for crabs becoming increasingly popular	The majority of the commercially and recreationally-fished stocks are concentrated in the coastal embayments and estuaries between Geographe Bay in the south west and Nickol Bay in the north. Crabbing activity along the Pilbara coast is centred largely on the inshore waters from Onslow through to Port Hedland, with most commercial and recreational activity occurring in and around Nickol Bay. Wholly within the EMBA
Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*), bluespotted emperor (*Lethrinus punctulatus*), crimson snapper (*Lutjanus erythropterus*), saddletail snapper (*Lutjanus malabaricus*), Rankin cod (*Epinephelus multinotatus*), brownstripe snapper (*Lutjanus vitta*), rosy threadfin bream (*Nemipterus furcosus*), spangled emperor (L*ethrinus nebulosus*) and frypan Moses' snapper (*Argyrops lutjanusspinifer russelli*).	2017/2018: 1,780 t 2022/2023: Commercial: 1784 t	Demersal trawl	The Pilbara Fish Trawl (Interim) Managed Fishery is situated in the Pilbara region in the north west of Australia. It occupies the waters north of latitude 21°35'S and between longitudes 114°9'36"E and 120°E. The Fishery is seaward of the 50 m isobath and landward of the 200 m isobath. The Fishery consists of two zones; Zone 1 in the south west of the Fishery (which is closed to trawling) and Zone 2 in the North, which consists of six management areas. Wholly within the EMBA
Pilbara Trap Managed Fishery (PTMF)	Blue-spot emperor (*Lethrinus hutchinsi*), Red snapper (*Lutjanus erythropterus)*, Goldband snapper (*Pristipomoides multidens*), Scarlet perch (*Lutjanus malabaricus)*, Red emperor (*Lutjanus sebae*), Spangled emperor (*Lethrinus nebulosus*), Rankin cod (*Epinephelus multinotatus*)	2017/2018: 400–600 t 2022/2023: Commercial: 597 t	Use of rectangular traps with single opening and 50 mm x 70 mm rectangular mesh panels. Trap fishing normally targets areas around rocky outcrops and reefs	Permitted to operate within waters bounded by a line commencing at the intersection of 21°56´ S latitude and the high-water mark on the western side of the North West Cape. Wholly within the EMBA

Fishery	Target Species	Catch1	Fishing Method	Area Description
Pilbara Line Managed Fishery	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens)*, red emperor *(Lutjanus sebae)*, bluespotted emperor (*Lethrinus punctulatus*), crimson snapper *(Lutjanus erythropterus*), saddletail snapper (*Lutjanus malabaricus)*, Rankin cod (*Epinephelus multinotatus*), brownstripe snapper (*Lutjanus vitta*), rosy threadfin bream (*Nemipterus furcosus*), spangled emperor (*Lethrinus nebulosus*) and frypan snapper (A*rgyrops spinifer*), Ruby snapper (*Etelis carbunculus*) and eightbar grouper (*Hyporthodus octofasciatus*)	2017/2018: 50–115 t 2022/2023: Commercial: 104 t	Line	The Pilbara Trap Managed Fishery lies north of latitude 21°44´ S and between longitudes 114°9´36´´ E and 120° E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath. Wholly within the EMBA
Specimen Shell Managed Fishery (SSF)	Shells (cowries, cones) The Specimen Shell Managed Fishery (SSF) is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. Just under 200 (196) different Specimen Shell species were collected in 2012, using a variety of methods.	2017/2018: 7,806 shells 2022/2023: 5,074 shells	Hand harvest while diving or wading along coastal beaches below the high-water mark An exemption method being employed by the fishery is using a remote-controlled underwater vehicle at depths between 60 and 300 m.	Dive based fishery operating all year throughout WA waters but restricted by diving depths. The fishing area includes all Western Australian waters between the high-water mark and the 200 m isobath. While the fishery covers the entire WA coastline, there is some concentration of effort in areas adjacent to population centres such as Broome, Karratha, Exmouth, Shark Bay, metropolitan Perth, Mandurah, the Capes area and Albany. Partially within the EMBA
South West Coast Salmon Managed Fishery	WA salmon (*Arripis truttaceus*)	Insufficient information	Insufficient information	Insufficient information Various beaches south of the metropolitan area. Wholly within the combined EMBA
Mackerel Fishery	Spanish mackerel (*Scomberomorus commerson*), grey mackerel (*S. semifasciatus*), with other species from the genera Scomberomorus, Grammatorcynus and Acanthocybium also contributing to commercial catches.	2016: Commercial: The commercial catch of Spanish mackerel was 276 t in 2016 (Gaughan & Santoro, 2018) 2022/2023: Commercial:197 t Recreational: 89-138 t	Trolling or handline Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands. Jig fishing is also used to capture grey mackerel (S.semifasciatus)	The Fishery extends from the West Coast Bioregion to the WA/NT border, to the 200 nautical mile AFZ with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts of the Northern Bioregion. Restricted to coastal and shallower waters. Catches are reported separately for three Areas: Area 1 – Kimberley (121º E to WA/NT border) Area 2 -Pilbara (114º E to 121º E) Area 3 – Gascoyne (27º S to 114º E) and West Coast (Cape Leeuwin to 27º S). Wholly within the EMBA

Fishery	Target Species	Catch1	Fishing Method	Area Description
Western Australian Pearl Oyster Managed Fishery	Indo- Pacific silver-lipped pearl oyster (*Pinctada maxima*).	2018: 468,573 shells 2022/2023: Commercial: 756,531 shells	Drift diving restricted to shallow diveable depths. The collection of pearl oysters for the Pearl Oyster Managed Fishery is restricted to shallow diving depths below 35 m. Divers are attached to large outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting legalised oysters by hand as they are seen.	The fishery is separated into four zones: Pearl Oyster Zone 1: NW Cape (including Exmouth Gulf) to longitude 119°30'E. There are five licensees in this zone. No fishing in this zone since 2008 Pearl Oyster Zone 2: East of Cape Thouin (118°20´ E) and south of latitude 18°14´ S. The 9 licensees in this zone also have full access to Zone 3. This zone is the mainstay of the fishery. Pearl Oyster Zone 3: West of longitude 125°20´ E and north of latitude 18°14´ S. The 2 licensees in this zone also have partial access to Zone 2. Pearl Oyster Zone 4: East of longitude 125°20´ E to the Western Australia/Northern Territory border. Although all licensees have access to this zone, exploratory fishing has shown that stocks in this area are not economically viable. However, pearl farming does occur. Wholly within the EMBA
Western Australian Sea Cucumber Fishery (formerly known as Beche-de-mer)	Sandfish (*Holothuria scabra*) and deepwater redfish (*Actinopyga echinites*).	2016: 93 t 2022/2023: Commercial: 56 t	Hand-harvest fishery, with animals caught principally by diving, and a smaller amount by wading.	The Western Australian Sea Cucumber Fishery is permitted to operate throughout WA waters with the exception of a number of specific closures around the Dampier Archipelago, Cape Keraudren, Cape Preston and Cape Lambert, the Rowley Shoals and the Abrolhos Islands. The fishery is primarily based in the northern half of the State, from Exmouth Gulf to the Northern Territory border. Wholly within the EMBA
West Coast Deep Sea Crustacean (Interim) Managed Fishery	Crystal (Snow) crabs (*Chaceon albus*), Giant (King) crabs (P*seudocarcinus gigas*) and Champagne (Spiny) crabs (*Hypothalassia acerba*).	2017/2018: 164.4 t Commercial: Class A: 123.2 t Class B: 10 t Class C: 0.1 t	Baited pots operated in a longline formation in the shelf edge waters (>150 m)	North of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the AFZ, mostly in 500 to 800 m of water. Wholly within the combined EMBA
Commonwealth Managed Fisheries				
Western Skipjack Tuna Fishery	Skipjack tuna (*Katsuwonus pelamis*)	2017-18: None in either zone No catch since 2008/09 fishing season 9 permits awarded 2021/2022	Purse seine	The Skipjack Tuna Fishery is split into two sectors; east and west. The Western Skipjack Tuna Fishery is located in all Australia waters west of 142° 30' 00°E, out to 200 nm from the coast. There has been no fishing effort in the Skipjack Tuna Fishery since the 2008-09 season, and in that season activity concentrated off South Australia (Department of Agriculture 2019). Partially within the EMBA

Fishery	Target Species	Catch1	Fishing Method	Area Description
Southern Bluefin Tuna Fishery	Southern bluefin tuna (Thunnus maccoyii).	2017-18: 6,159 t 2022: 5,972 t	Purse seine vessels primarily in Great Australian Bight all year round and longline off southern NSW in winter. Around 98% of Australia's SBT quota is taken by 5–10 purse seine vessels fishing for 13–25 kg southern bluefin tuna.	Fishery includes all waters of Australia, out to 200 nm from the coast. No current effort on the North West Shelf, fishing activity is concentrated in the Great Australian Bight and off South-east Australia (Department of Agriculture 2019). Partially within the combined EMBA
Western Tuna and Billfish Fishery	Broadbill swordfish (*Xiphias gladius*), albacore tuna (*Thunnus alalunga)*, striped marlin (*Kajikia audax*), bigeye tuna (*T. obesus)* and yellowfin tuna (*T. albacares*).	2018: 278 t 2022: 139 t	Pelagic, longline, minor line and purse seine.	Extends westward from Cape York Peninsula (142°30' E) off Queensland to 34° S off the WA west coast. It also extends eastward from 34° S off the west coast of WA across the Great Australian Bight to 141° E at the South Australian–Victorian border. In recent years, fishing effort has concentrated off south-west Western Australia and South Australia with no current effort on the North West Shelf (Department of Agriculture 2019). Partially within the EMBA

Source: Apache (2008); Australian Fisheries Management Authority (2011); Department of Fisheries (2013), Stakeholder consultation.
[1]Sources for catch data: Department of Agriculture 2019; Gaughan et al., 2019; DPIRD 2018, DPIRD 2023, Newman et al 2023

16.7. Aquaculture

16.7.1. North Coast Bioregion

WA is split into marine bioregions for the purpose of managing recreational fishing. The North Coast Bioregion (Pilbara/Kimberley) runs from the Ashburton River (21° 46' S and 114° 50' E), south of Onslow to the WA/NT border.

Aquaculture development in this region is dominated by the production of pearls from the species *Pinctada maxima.* Each year, approximately 500,000 wild individuals are harvested, with the majority being from Eighty Mile Bean in Broome, Western Australia (sourced from Fisheries Research and Development Cooperation in Thomas and Miller 2022). A large number of pearl oysters for seeding is obtained from wild stocks and supplemented by hatchery-produced oysters with major hatcheries operating at Broome and the Dampier Peninsular. Pearl farm sites are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago, in Roebuck Bay and at the Montebello Islands. Developing marine aquaculture initiatives in this region include growing trochus and barramundi. The pearl fishery of Western Australia operates in shallow coastal waters (DoF 2006). All the leases are within the 35m diving depth, with commercial diving predominantly occurring in nearshore habitats of 8-15 m depths (sourced from Fisheries Research and Development Cooperation in Thomas and Miller, 2022). Thomas and Miller (2022) demonstrated high levels of gene flow among inshore (8-15 m water depth) and offshore sites (35 m water depth) and no differences in genetic diversity between depths indicating high levels of dispersal and connectivity among inshore and offshore fishing grounds

The Pearl Producer's Association (PPA) assert that spawning stock for pearl oysters occur out to the 100 m depth contour, however, evidence for this is lacking. Condie et al. (2006) modelled oyster larva transport in the Eighty Mile Beach region and found that while some larvae travelled more than 60 km, most were transported less than

30 km. The model results suggested that spawning in the Eighty Mile Beach region is concentrated around the 8 to 15m depth range, with potential smaller contributions from the northeast. These spawning events are likely to lead to successful recruitment locally and alongshore to the southwest.

However, spat abundances seem to be low in these areas, suggesting that recruitment is strongly limited by habitat availability and possibly high mortality rates in shallow water. High local abundances of broodstock and spat observed occasionally in deeper water (<30 m) seem to be supported by intermittent larval transport from inshore populations. Spawning in this area seems to contribute little to recruitment in the inshore populations.

16.8. Recreational Fisheries

16.8.1. North Coast Bioregion

WA is split into marine bioregions for the purpose of managing recreational fishing. The North Coast Bioregion (Pilbara/Kimberley) runs from the Ashburton River to the Western Australia/Northern Territory border (WAFIC 2016). The oceanography of this region includes waters of Pacific Ocean origin that enter through the Indonesian archipelago bringing warm, low salinity waters polewards via the Indonesian throughflow and Holloway currents which flow seasonally and interact with Indian ocean waters. Recreational fishing is experiencing a significant growth in this region, with a distinct seasonal peak in winter when the local population increases by significant numbers of metropolitan and inter-state tourists. This has been added to by the increased recreational fishing by those involved in the construction or operation of major developments in this region. Owing to the high tidal range, much of the angling activity is boat-based with beach fishing limited to periods of flood tides and high water. Numerous creek systems, mangroves, rivers and ocean beaches provide shore and small boat fishing for a variety of species including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin, mud crabs and cods. Offshore islands, coral reef systems and continental shelf waters provide species of major recreational interest including saddletail snapper and red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, mackerels and billfish (WAFIC 2016).

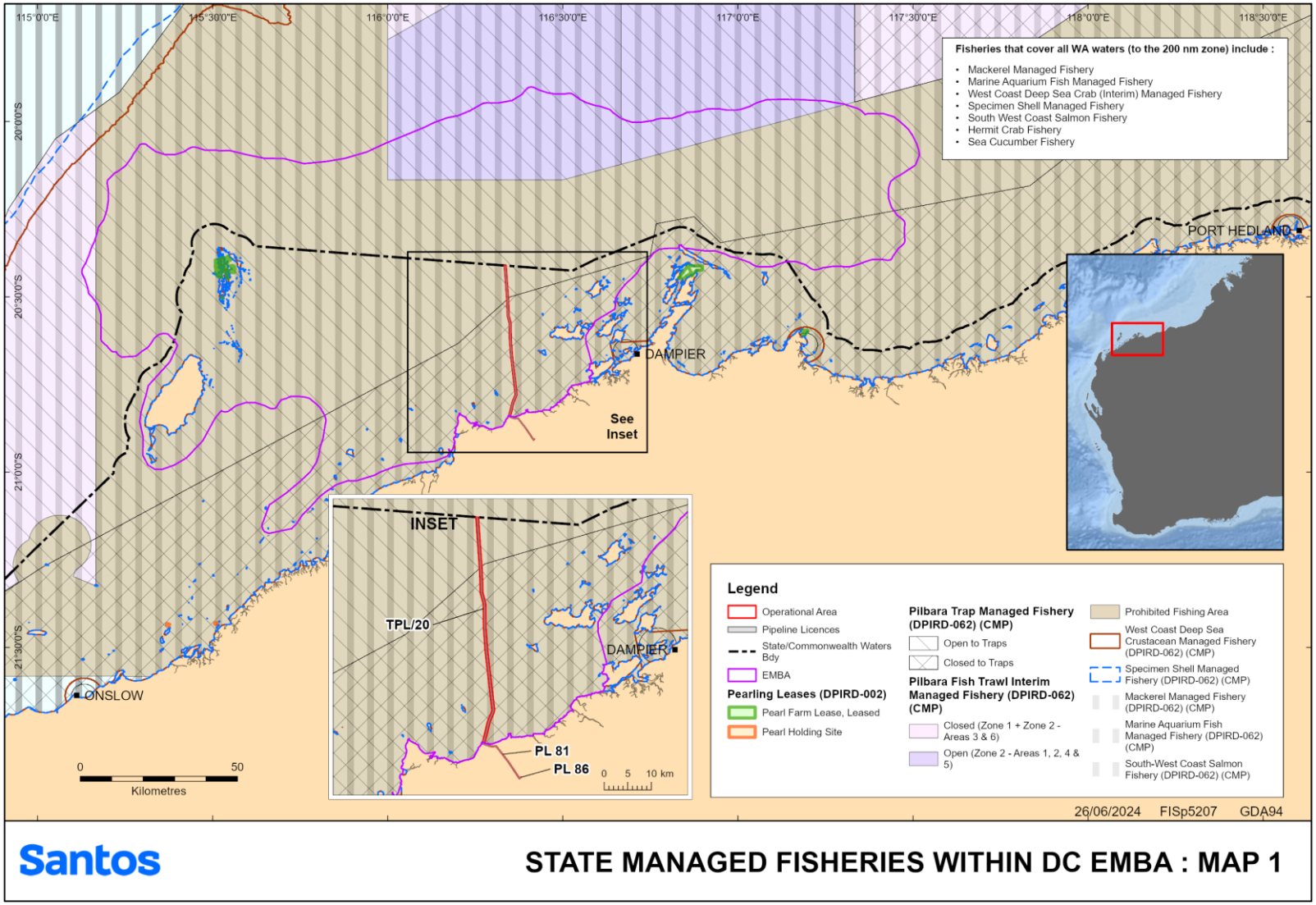


Figure 17: WA state commercial fishing zones (Map 1)

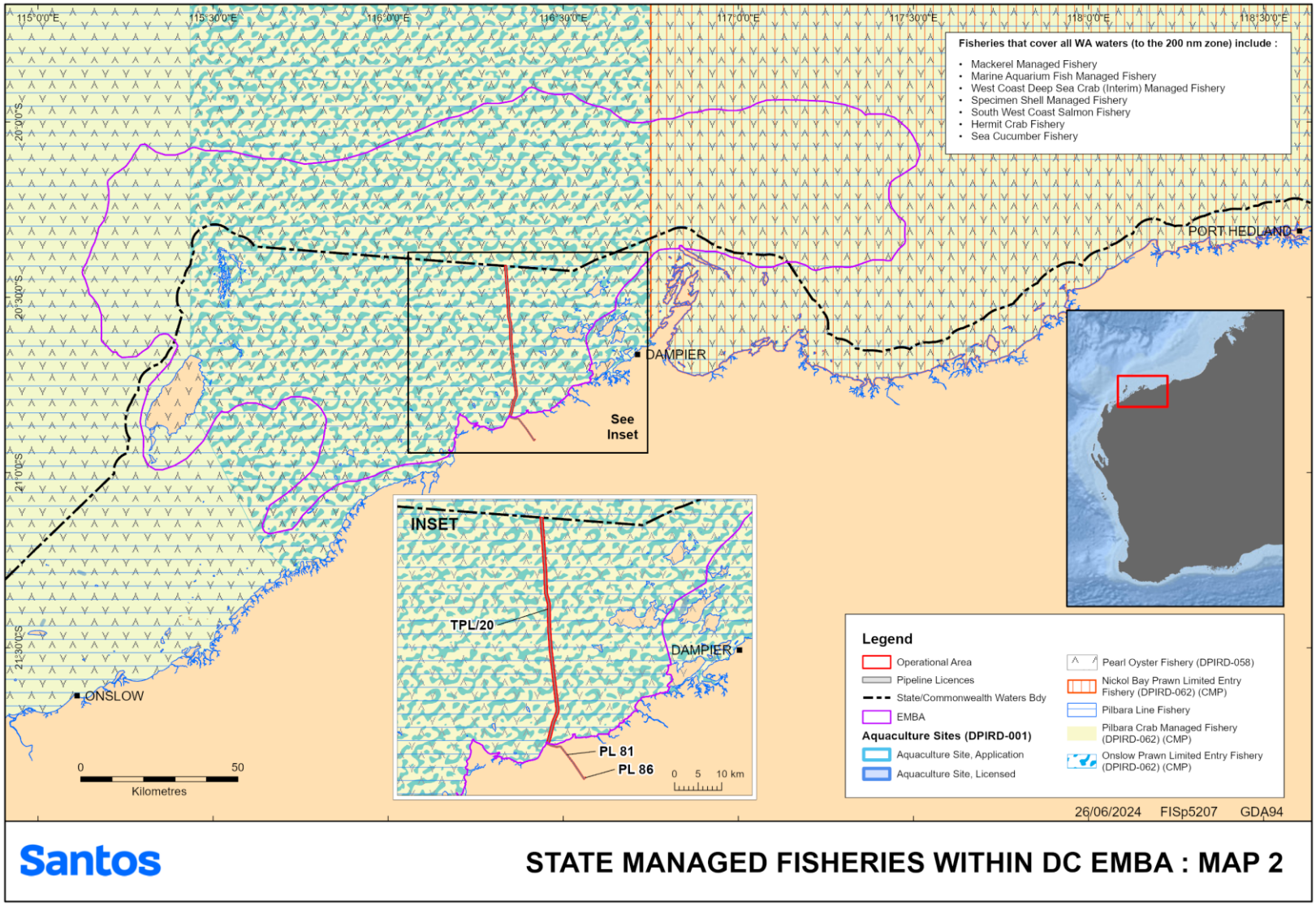


Figure 18: WA state commercial fishing zones (Map 2)

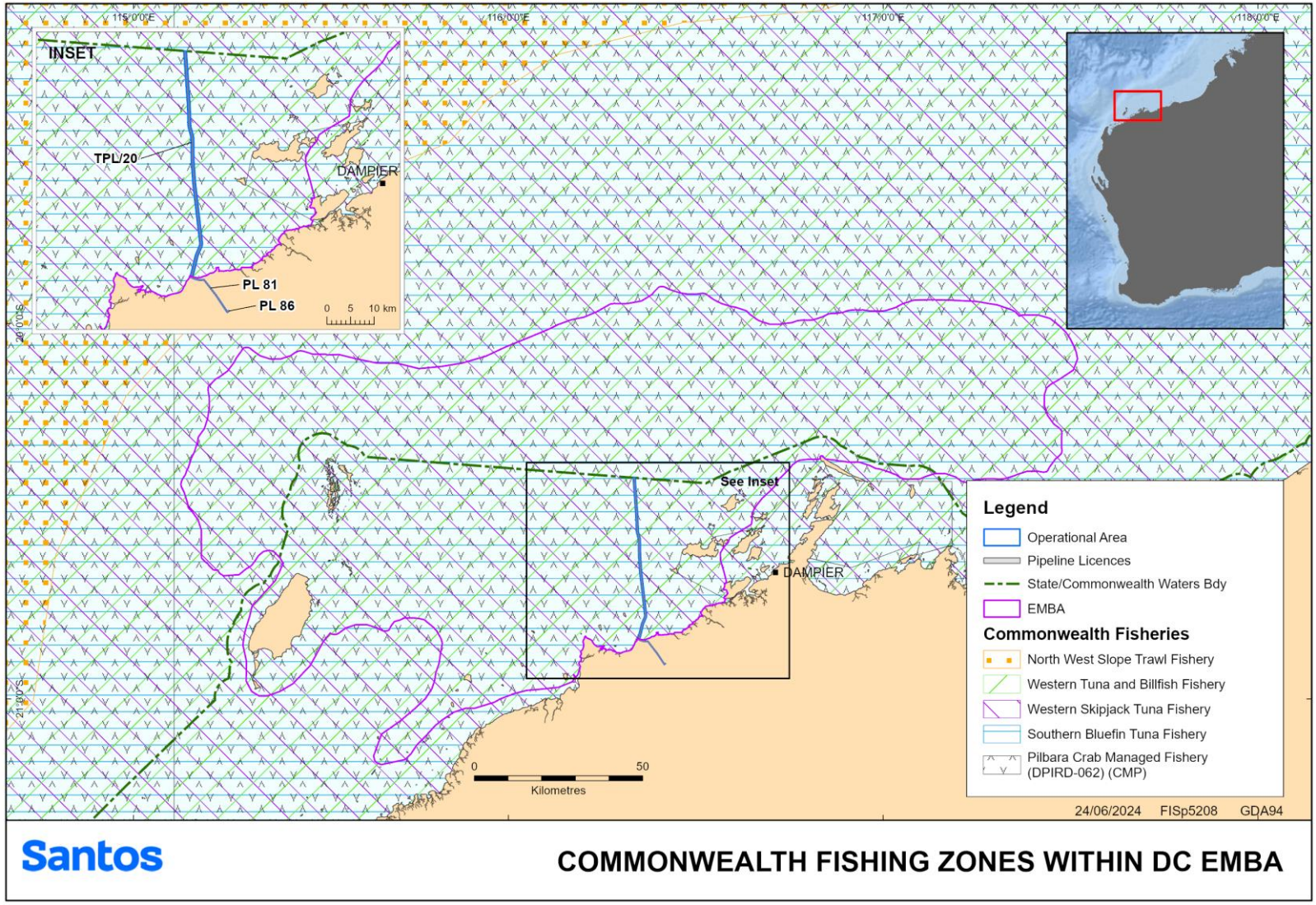


Figure 19: Commonwealth commercial fishing zones within the DC EMBA

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Appendix D PMST reports for this EP

It is noted that there are four PMST Searches:

- The DC operational area within State waters (hence no land is shown on the figure within the PMST output from DCCEEW).
- The DC EMBA.
- The CSB MEVA
- THE HDD MEVA

The searches are completed using the exact coordinates that are used to produce the figures throughout Section 3 of the EP, ensuring that the EMBA encompasses the full range of environmental receptors that might be contacted by surface and subsurface hydrocarbons at the low exposure level in the highly unlikely event of a worst case oil spill.

The coordinates are also provided within the PMST report to allow for duplication of the search and verification if required.

Santos do not have control over the PMST search tool output, but instead have provided the reports and coordinates to ensure transparency.

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: 15-Apr-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

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:	39
Listed Migratory Species:	51

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:	85
Whales and Other Cetaceans:	16
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	3

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:	14
Key Ecological Features (Marine):	None
Biologically Important Areas:	9
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 known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may 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
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	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

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Liasis olivaceus barroni Pilbara Olive Python [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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	Foraging, feeding or related behaviour known to 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		

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Species or species habitat may 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 likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely 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

Scientific Name	Threatened Category	Presence Text
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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat likely to 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 may 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	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known 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]	Vulnerable	Species or species habitat likely 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 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	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Sousa sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]	Vulnerable	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 likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to 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 known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to 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 known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
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	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 known to 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 likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely 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 veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may 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
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within 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 may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		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 trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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

Scientific Name	Threatened Category	Presence Text
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		
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to 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
Aipysurus tenuis Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding 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 czeblukovi Fine-spined Sea Snake [59233]		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 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 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
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		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 likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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]		Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely 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]	Vulnerable	Species or species habitat likely 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 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
All year (Jun - Aug)		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Oct - Feb		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Oct - Mar		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092		Completed
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Eramurra Industrial Salt Project	2021/9027	Controlled Action	Assessment Approach
Eramurra Industrial Salt Project, near Karratha, WA	2019/8448	Controlled Action	Completed
Not controlled action			
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Not controlled action (particular manner)			

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval

Biologically Important Areas		[Resource Information]
Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta		
Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Chelonia mydas		
Green Turtle [1765]	Internesting buffer	Known to occur
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Natator depressus		
Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Ardenna tenuirostris		
Short-tailed Shearwater [84292]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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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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: 15-Apr-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

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:	1
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	52
Listed Migratory Species:	60

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:	100
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	4
Habitat Critical to the Survival of Marine Turtles:	3

Extra Information

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

State and Territory Reserves:	16
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	79
Key Ecological Features (Marine):	2
Biologically Important Areas:	30
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places		[Resource Information]
Name	State	Legal Status
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place

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 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
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Falco hypoleucos Grey Falcon [929]	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 menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	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
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may 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
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
FISH		
Milyeringa justitia		
Barrow Cave Gudgeon [86867]	Endangered	Species or species habitat known to occur within area
Milyeringa veritas		
Cape Range Cave Gudgeon, Blind Gudgeon [66676]	Vulnerable	Species or species habitat may occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies		
Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	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
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Lagorchestes conspicillatus conspicillatus		
Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Osphranter robustus isabellinus		
Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis		
Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Sousa sahulensis		
Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama		
Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat 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	Breeding known to occur within area
Liasis olivaceus barroni Pilbara Olive Python [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
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		
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
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat likely to 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	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat may 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	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat may 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
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known 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

Scientific Name	Threatened Category	Presence Text
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		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	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat 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 may occur within area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may 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

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Thalasseus bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to 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 known to occur within area
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 overfly marine area
Ardenna pacifica as Puffinus pacificus		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis		
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat 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 may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely 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 veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within 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 may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within 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
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within 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 may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding 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 likely to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Thalasseus bengalensis as Sterna bengalensis](#) Lesser Crested Tern [66546]		Breeding known to occur within area
[Thalasseus bergii as Sterna bergii](#) Greater Crested Tern [83000]		Breeding known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
[Acentronura larsonae](#) Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
[Bulbonaricus brauni](#) Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus](#) Muiron Island Pipefish [66196]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		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
[Cosmocampus banneri](#) Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		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
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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		
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to 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

Scientific Name	Threatened Category	Presence Text
Aipysurus tenuis Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding 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 may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding 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 czeblukovi Fine-spined Sea Snake [59233]		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 kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 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
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
[Orcaella heinsohni](#) Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Peponocephala electra](#) Melon-headed Whale [47]		Species or species habitat may occur within area
[Physeter macrocephalus](#) Sperm Whale [59]		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]	Vulnerable	Species or species habitat known to occur within area
[Stenella attenuata](#) Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
[Stenella coeruleoalba](#) Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
[Stenella longirostris](#) Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
[Steno bredanensis](#) Rough-toothed Dolphin [30]		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

Current Scientific Name	Status	Type of Presence
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
Ziphius cavirostris		
Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
All year (Jun - Aug)		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Oct - Feb		
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Nesting	Known to occur
Oct - Mar		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Park	WA

Protected Area Name	Reserve Type	State
Barrow Island	Marine Management Area	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Great Sandy Island	Nature Reserve	WA
Great Sandy Island	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
North Sandy Island	Nature Reserve	WA
Unnamed WA36909	5(1)(h) Reserve	WA
Unnamed WA36913	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA
Unnamed WA40877	5(1)(h) Reserve	WA
Unnamed WA44667	5(1)(h) Reserve	WA

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092		Completed
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Gorgon Gas Development	2003/1294		Post-Approval
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335		Approval
Offshore Dredge Spoil Disposal - Mardie Project	2024/10054		Referral Decision
Optimised Mardie Project ? Additional Triodia Grassland Habitat Clearing	2024/10094		Referral Decision
Optimised Mardie Solar Salt Project	2022/9169		Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Anketell Point Iron Ore Processing & Export Port	2009/5120	Controlled Action	Post-Approval
Balmoral South Iron Ore Mine	2008/4236	Controlled Action	Post-Approval
Binowee Iron Ore Project	2001/366	Controlled Action	Proposed Decision
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Eramurra Industrial Salt Project	2021/9027	Controlled Action	Assessment Approach
Eramurra Industrial Salt Project, near Karratha, WA	2019/8448	Controlled Action	Completed
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Mardie Project, 80 km south west of Karratha, WA	2018/8236	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
Not controlled action			
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Expansion of the Sino Iron Ore Mine and export facilities, Cape Preston, WA	2017/7862	Not Controlled Action	Completed
Expansion Proposal, Mineralogy Cape Preston Iron Ore Project, Cape Preston, WA	2009/5010	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Mermaid Marine Australia Desalination Project	2011/5916	Not Controlled Action	Completed
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in WA 457-P & WA 458-P, North West Shelf, offshore WA	2013/6862	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
Cape Preston East - Iron Ore Export Facilities, Pilbara, WA	2013/6844	Not Controlled Action (Particular Manner)	Post-Approval
Cerberus exploration drilling campaign, Carnarvon Basin, WA	2016/7645	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression p	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Port Walcott upgrade, dredging & spoil disposal, & channel realignment	2006/2806	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Scarborough Development nearshore component, NWS, WA	2018/8362	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	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
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Aggregation	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Migration corridor	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Migration corridor	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Aggregation	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Migration corridor	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna tenuirostris Short-tailed Shearwater [84292]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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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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: 15-Apr-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

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:	1
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	48
Listed Migratory Species:	57

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:	97
Whales and Other Cetaceans:	16
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	4
Habitat Critical to the Survival of Marine Turtles:	3

Extra Information

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

State and Territory Reserves:	9
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	28
Key Ecological Features (Marine):	None
Biologically Important Areas:	23
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places		[Resource Information]
Name	State	Legal Status
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place

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 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
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	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 lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may 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
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
FISH		
Milyeringa justitia		
Barrow Cave Gudgeon [86867]	Endangered	Species or species habitat likely to occur within area
Milyeringa veritas		
Cape Range Cave Gudgeon, Blind Gudgeon [66676]	Vulnerable	Species or species habitat may occur within area
MAMMAL		
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
Bettongia lesueur Barrow and Boodie Islands subspecies		
Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus		
Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Osphranter robustus isabellinus		
Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis		
Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Sousa sahulensis		
Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama		
Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus		
Hamelin Ctenotus [25570]	Vulnerable	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	Breeding known to occur within area
Liasis olivaceus barroni		
Pilbara Olive Python [66699]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	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	Foraging, feeding or related behaviour known to 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 likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat likely to 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	Breeding 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 may 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	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known 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]	Vulnerable	Species or species habitat likely 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 may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat 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 may occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to 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 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
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat 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 may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within 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 may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding 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 likely to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
[Thalasseus bengalensis as Sterna bengalensis](#) Lesser Crested Tern [66546]		Breeding known to occur within area
[Thalasseus bergii as Sterna bergii](#) Greater Crested Tern [83000]		Breeding known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
[Acentronura larsonae](#) Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
[Bulbonaricus brauni](#) Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus](#) Muiron Island Pipefish [66196]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		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
[Cosmocampus banneri](#) Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		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
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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		
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to 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

Scientific Name	Threatened Category	Presence Text
Aipysurus tenuis Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding 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 may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding 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 czeblukovi Fine-spined Sea Snake [59233]		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 kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 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
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata		
Minke Whale [33]		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 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]		Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely 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]	Vulnerable	Species or species habitat 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

Current Scientific Name	Status	Type of Presence
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
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
All year (Jun - Aug)		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Oct - Feb		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Oct - Mar		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Management Area	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Montebello Islands	Conservation Park	WA

Protected Area Name	Reserve Type	State
Unnamed WA36915	Nature Reserve	WA
Unnamed WA40877	5(1)(h) Reserve	WA

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092		Completed
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Gorgon Gas Development	2003/1294		Post-Approval
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335		Approval
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
Not controlled action			
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression p	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval
Scarborough Development nearshore component, NWS, WA	2018/8362	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Varanus Island Compression Project	2012/6698	Referral Decision	Completed

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur

Scientific Name	Behaviour	Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna tenuirostris Short-tailed Shearwater [84292]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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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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: 15-Apr-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

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:	1
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	38
Listed Migratory Species:	50

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:	83
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	3

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	13
Key Ecological Features (Marine):	None
Biologically Important Areas:	23
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	State	Legal Status
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place

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 likely 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
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limnodromus semipalmatus		
Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may 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
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
MAMMAL		
Balaenoptera musculus Blue Whale [36]	Endangered	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
[Orcaella heinsohni](#) Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
[Rhinonicteris aurantia (Pilbara form)](#) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
[Sousa sahulensis](#) Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
[Aipysurus apraefrontalis](#) Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
[Aipysurus foliosquama](#) Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	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	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Liasis olivaceus barroni		
Pilbara Olive Python [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	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	Breeding likely 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
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
[Ardenna pacifica](#) Wedge-tailed Shearwater [84292]		Breeding known to occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat may occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
[Hydroprogne caspia](#) Caspian Tern [808]		Breeding known to occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat may occur within area
[Sterna dougallii](#) Roseate Tern [817]		Breeding likely to occur within area
[Sternula albifrons](#) Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to 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
[Carcharhinus longimanus](#) Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat likely to 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 may 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	Breeding known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known 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

Scientific Name	Threatened Category	Presence Text
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely 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 may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding likely 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]	Vulnerable	Species or species habitat known to 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 Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely 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 may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to 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 known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding 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	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
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 may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely 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 veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within 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 may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may 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
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within 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
Sterna dougallii		
Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
Bulbonaricus brauni		
Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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
Doryrhamphus janssi		
Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis		
Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris		
Ladder Pipefish [66216]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		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 angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		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

Scientific Name	Threatened Category	Presence Text
Hippocampus trimaculatus		
Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		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		
Aipysurus apraefrontalis		
Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii		
Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to 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
Aipysurus tenuis Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		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 may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding 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

Scientific Name	Threatened Category	Presence Text
Hydrophis czeblukovi Fine-spined Sea Snake [59233]		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 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 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
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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
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 known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]	Vulnerable	Species or species habitat 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 likely to occur within area

Current Scientific Name	Status	Type of Presence
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
All year (Jun - Aug)		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Oct - Feb		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Oct - Mar		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Great Sandy Island	Nature Reserve	WA
Great Sandy Island	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Balmoral South Iron Ore Mine	2008/4236	Controlled Action	Post-Approval
Binowee Iron Ore Project	2001/366	Controlled Action	Proposed Decision
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Eramurra Industrial Salt Project	2021/9027	Controlled Action	Assessment Approach
Eramurra Industrial Salt Project, near Karratha, WA	2019/8448	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Not controlled action			
Expansion of the Sino Iron Ore Mine and export facilities, Cape Preston, WA	2017/7862	Not Controlled Action	Completed
Expansion Proposal, Mineralogy Cape Preston Iron Ore Project, Cape Preston, WA	2009/5010	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Not controlled action (particular manner)			
Cape Preston East - Iron Ore Export Facilities, Pilbara, WA	2013/6844	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval

Biologically Important Areas		[Resource Information]
Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Migration corridor	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Migration corridor	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Migration corridor	Known to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna tenuirostris Short-tailed Shearwater [84292]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Whales		
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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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Appendix E ACHIS results

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

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Search Criteria

41 Aboriginal Cultural Heritage (ACH) Lodged in Shapefile - State EMBA Generalised

Disclaimer

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Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- **Boundary Reliable (Yes/No):** Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- **Boundary Restricted = No:** Represents the actual location of the ACH as understood by the Department..
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Culturally Sensitive = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- **Culturally Sensitive = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- **Culturally Sensitive Nature:**
  - **No Gender / Initiation Restrictions:** *Anyone* can view the information.
  - **Men only:** Only *males* can view restricted information.
  - **Women only:** Only *females* can view restricted information.

Status:

- **Register:** Aboriginal cultural heritage places that are assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*.
- **Lodged:** Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the *Aboriginal Heritage Act 1972.*
- **Historic:** Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the *Aboriginal Heritage Act 1972*. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.
Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

Basemap Copyright

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
883	BARROW ISLAND 01	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
884	I-24-S0001/S0002	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
885	BARROW ISLAND 03	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
886	C-21-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
887	O-02-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
888	P-05-S0001	No	No	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
889	O-06-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
890	D-20-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
891	Bandicoot Bay Settlement	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
892	BARROW ISLAND 10	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
893	D-20-S0002	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
894	D-16-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
935	ENDERBY IS.24: LIMESTONE	No	No	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Traditional Structure	*Registered Knowledge Holder names available from DPLH	
976	ROSEMARY IS.21: HALFWAY CK	No	No	No	No Gender / Initiation Restrictions	Lodged	Traditional Structure	*Registered Knowledge Holder names available from DPLH	
6965	ENDERBY ISLAND 07	No	No	No	No Gender / Initiation Restrictions	Lodged	Midden	*Registered Knowledge Holder names available from DPLH	
19171	Ceremonial Ground	Yes	Yes	No	Men only	Lodged	Ritual / Ceremonial; Creation / Dreaming Narrative; Engraving	*Registered Knowledge Holder names available from DPLH	
22943	Flacourt Bay 01	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Rock Shelter	*Registered Knowledge Holder names available from DPLH	

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List of Aboriginal Cultural Heritage (ACH) Lodged

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
29549	Boodie Soak	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
31762	Site 1	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
31763	Site 2	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36199	Boodie Cave	No	Yes	No		Lodged	Artefacts / Scatter; Rock Shelter	*Registered Knowledge Holder names available from DPLH	
36200	John Wayne Country Rockshelter	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter; Rock Shelter	*Registered Knowledge Holder names available from DPLH	
36234	South End structures, Barrow Island.	No	No	No		Lodged	Historical; Traditional Structure	*Registered Knowledge Holder names available from DPLH	
36261	G-13-S0001	No	Yes	No		Lodged	Quarry	*Registered Knowledge Holder names available from DPLH	
36262	H-24-S0001	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36263	H-24-S0002	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36264	I-23-S0001	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36265	I-23-S0002	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36266	I-24-S0003	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36267	J-23-S0001	No	Yes	No		Lodged	Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	
36268	J-23-S0002	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36269	J-23-S0003	No	Yes	No		Lodged	Modified Tree	*Registered Knowledge Holder names available from DPLH	
36270	M-03-S0001	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36271	N-02-S0001	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	

Aboriginal Cultural Heritage Inquiry System

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
36272	O-02-S0002	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36273	O-05-S0003	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36344	N-05-S0002	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36345	N-05-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36346	O-05-S0001	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36347	O-05-S0002	No	Yes	No	No Gender / Initiation Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	
36348	P-04-S0001	No	Yes	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Lodged

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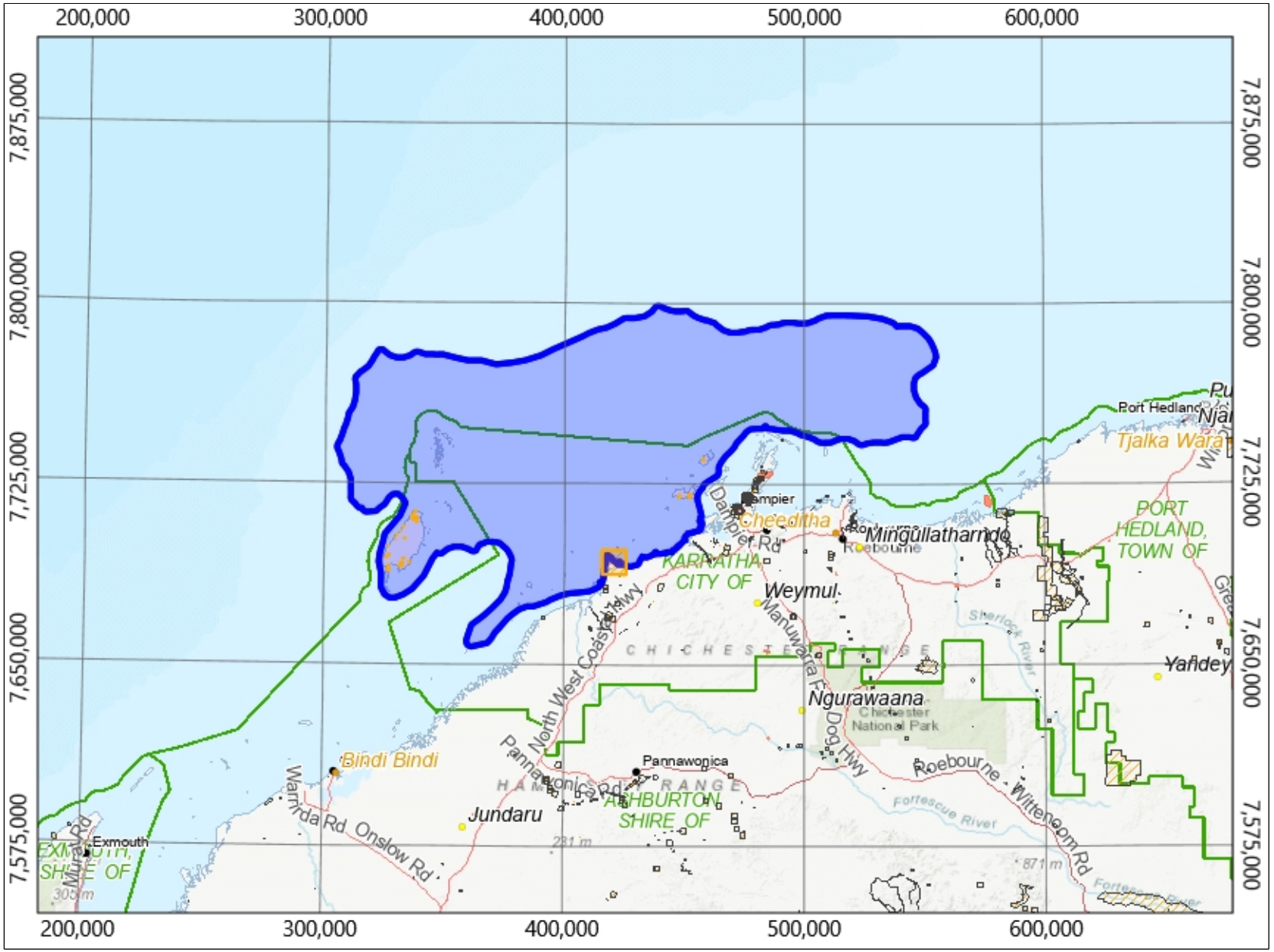

Legend

- Aboriginal Cultural Heritage (ACH) Lodged
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

85.00 kilometres

Map Scale 1 : 2,580,000

MGA Zone 50 (GDA2020)

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Lodged

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Search Criteria

No Aboriginal Cultural Heritage (ACH) Lodged in Shapefile - ENVIRON_OFSHR_OPERATIONAL_AREAS

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Coordinates

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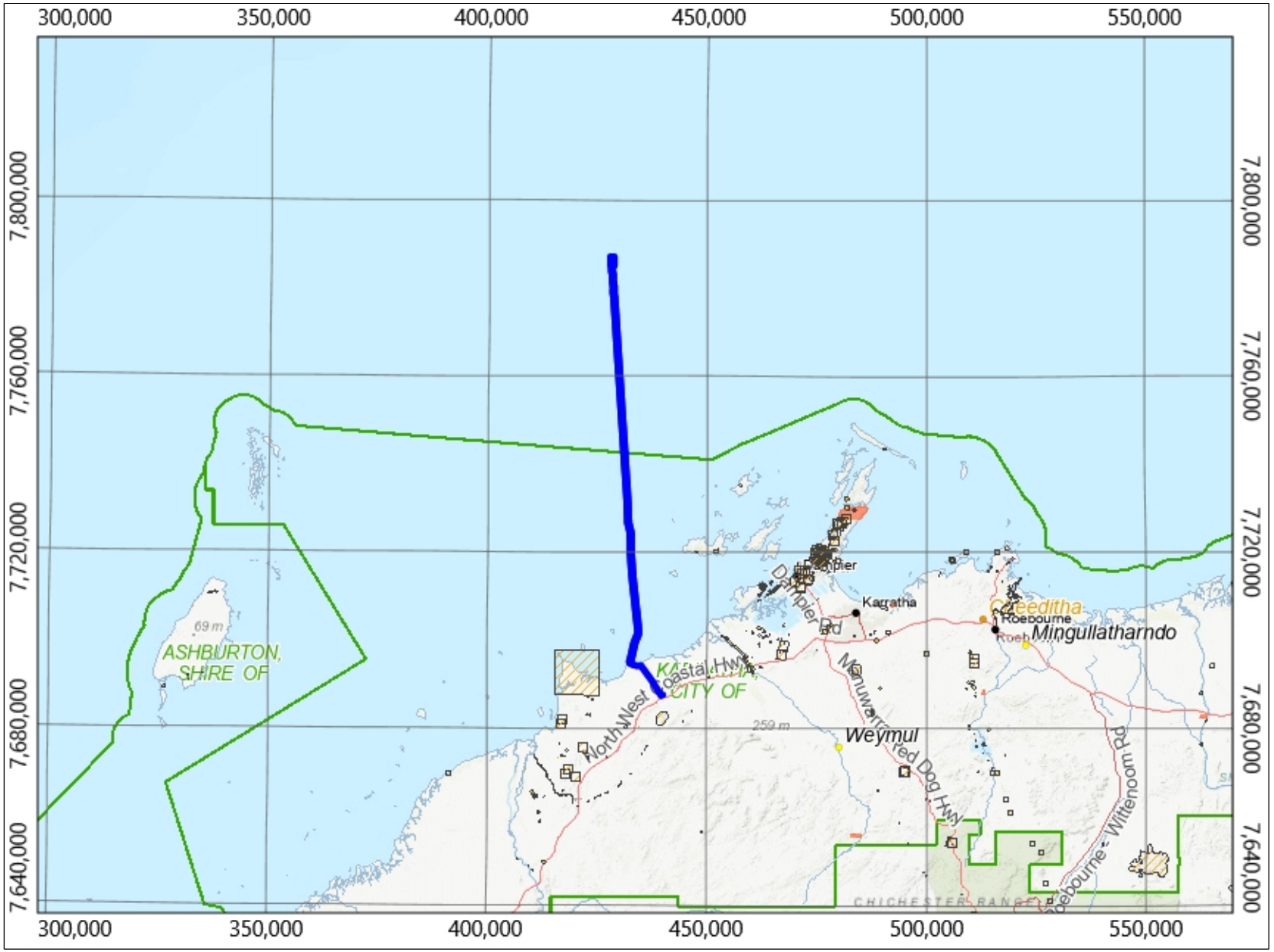

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46.50 kilometres

Map Scale 1 : 1,410,000

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

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Search Criteria

55 Aboriginal Cultural Heritage (ACH) Register in Shapefile - State EMBA Generalised

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- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

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List of Aboriginal Cultural Heritage (ACH) Register

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873	MONTEBELLO IS: NOALA CAVE.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	P07287
911	40 MILE - EASTERN POINT	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07271
912	40 MILE - EASTERN DUNES	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	P07272
919	ENDERBY IS.27: GOODWYN VIEW	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07279
926	MONTEBELLO IS: HAYNES CAVE.	No	Yes	No	No Gender / Initiation Restrictions	Register	Sub surface cultural material; Artefacts / Scatter; Midden; Rock Shelter	*Registered Knowledge Holder names available from DPLH	P07286
927	ENDERBY IS.16: WHITE BASIN	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07233
929	ENDERBY IS.18: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	P07235
930	ENDERBY IS.19: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	P07236
931	ENDERBY IS.20: MANGROVE CK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07237
932	ENDERBY IS.21: BACK QUARRY	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	P07238
933	ENDERBY IS.22: TEREBRALIA	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07239
934	ENDERBY IS.23: GRINDING	No	No	No	No Gender / Initiation Restrictions	Register	Engraving; Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	P07240
936	ENDERBY IS.25: DINGHY MIDDEN	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07242
937	ENDERBY IS.26: NORTH POINT	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	P07243
966	ROSEMARY IS.11: CHOOKIE BAY	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07219
967	ROSEMARY IS.12: CHOOKIE BAY	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	P07220
968	ROSEMARY IS.13	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	P07221

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969	ROSEMARY IS.14	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	P07222
970	ROSEMARY IS.15: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Grinding areas / Grooves; Midden	*Registered Knowledge Holder names available from DPLH	P07223
971	ROSEMARY IS.16: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	P07224
972	ROSEMARY IS.17: AIRSTRIP	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Quarry	*Registered Knowledge Holder names available from DPLH	P07225
973	ROSEMARY IS.18: DEEP WATER	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07226
974	ROSEMARY IS.19: CHITON	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07227
975	ROSEMARY IS.20: HALFWAY CK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07228
977	ROSEMARY IS.22	No	No	No	No Gender / Initiation Restrictions	Register	Engraving; Traditional Structure	*Registered Knowledge Holder names available from DPLH	P07230
978	ROSEMARY IS.23: WADJURU R/H	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Engraving; Grinding areas / Grooves; Traditional Structure; Midden; Water Source	*Registered Knowledge Holder names available from DPLH	P07231
979	ROSEMARY IS.24: HUNGERFORD	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07232
6078	ROSEMARY ISLAND 10	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07019
6079	ENDERBY ISLAND 12	No	Yes	No	No Gender / Initiation Restrictions	Register	Traditional Structure	*Registered Knowledge Holder names available from DPLH	P07020
6080	ENDERBY ISLAND 13	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07021
6081	ENDERBY ISLAND 14	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07022
6082	ENDERBY ISLAND 15	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07023
6184	ENDERBY ISLAND 09: SE	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Fish Trap; Midden	*Registered Knowledge Holder names available from DPLH	P06917
6185	ENDERBY ISLAND 10: N.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Engraving; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	P06918

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
6186	ENDERBY ISLAND 11: NE.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Ritual / Ceremonial; Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	P06919
6966	ENDERBY ISLAND 08	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P05955
9737	ENDERBY ISLAND 06: BOILER B	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Quarry	*Registered Knowledge Holder names available from DPLH	P02449
11328	GAP WELL	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00836
11771	ENDERBY ISLAND 05	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00368
11772	ROSEMARY ISLAND 09	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P00369
11773	ROSEMARY ISLAND 08	No	No	No	No Gender / Initiation Restrictions	Register	Engraving; Grinding areas / Grooves; Traditional Structure	*Registered Knowledge Holder names available from DPLH	P00370
11774	ROSEMARY ISLAND 07	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00371
11775	ROSEMARY ISLAND 06	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00372
11776	ROSEMARY ISLAND 04.	No	No	No	No Gender / Initiation Restrictions	Register	Camp; Engraving	*Registered Knowledge Holder names available from DPLH	P00373
11777	ROSEMARY ISLAND 03	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00374
11789	ROSEMARY ISLAND 01	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Engraving; Midden; Quarry	*Registered Knowledge Holder names available from DPLH	P00386
11818	ROSEMARY ISLAND 02	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00362
11819	ROSEMARY ISLAND 05	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00363
11820	ENDERBY ISLAND 01	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00364
11821	ENDERBY ISLAND 02	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P00365
11822	ENDERBY ISLAND 03	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00366

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
11823	ENDERBY ISLAND 04	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Engraving; Midden	*Registered Knowledge Holder names available from DPLH	P00367
26005	Site No. 18	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	
26006	Site No. 25	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	
26736	ACHM - 09-05	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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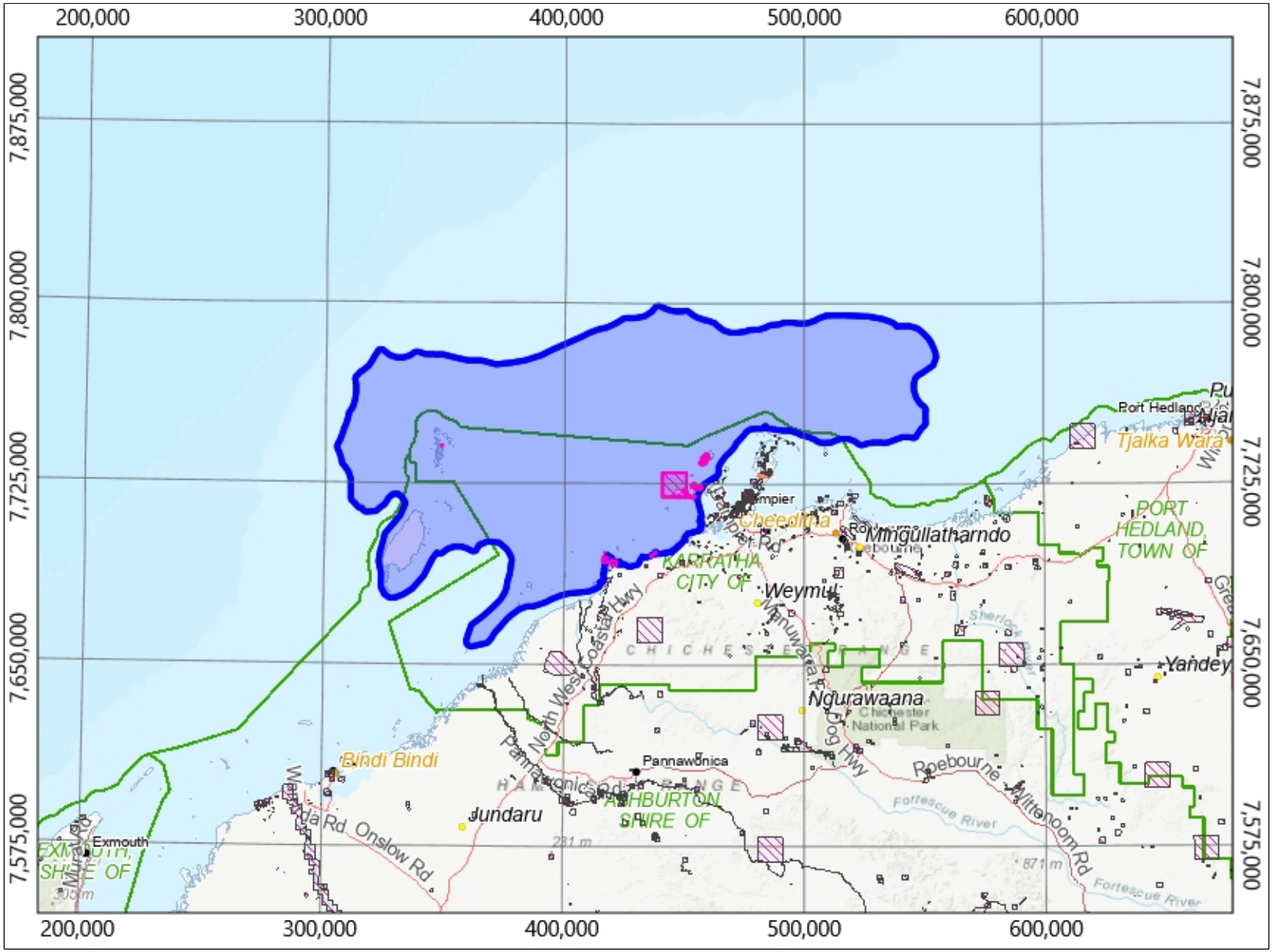

Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

85.00 kilometres

Map Scale 1 : 2,580,000

MGA Zone 50 (GDA2020)

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

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Search Criteria

1 Aboriginal Cultural Heritage (ACH) Register in Shapefile - ENVIRON_OFSHR_OPERATIONAL_AREAS

Disclaimer

Aboriginal heritage holds significant value to Aboriginal people for their social, spiritual, historical, scientific, or aesthetic importance within Aboriginal traditions, and provides an essential link for Aboriginal people to their past, present and future. In Western Australia Aboriginal heritage is protected under the Aboriginal Heritage Act 1972.

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Terminology

ID: ACH on the Register is assigned a unique ID by the Department of Planning, Lands and Heritage using the format: ACH-00000001. For ACH on the former Register the ID numbers remain unchanged and use the new format. For example the ACH ID of the place Swan River was previously '3536' and is now 'ACH-00003536'.

Access and Restrictions:

- Boundary Reliable (Yes/No): Indicates whether to the best knowledge of the Department, the location and extent of the ACH boundary is considered reliable.
- Boundary Restricted = No: Represents the actual location of the ACH as understood by the Department..
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the ACH is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Culturally Sensitive = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the ACH is not restricted in any way.
- Culturally Sensitive = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the ACH is restricted if it is considered culturally sensitive information. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the people who provided the information. To request access please contact via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.
- Culturally Sensitive Nature:
  - No Gender / Initiation Restrictions: Anyone can view the information.
  - Men only: Only males can view restricted information.
  - Women only: Only females can view restricted information.

Status:

- Register: Aboriginal cultural heritage places that are assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Lodged: Information which has been received in relation to an Aboriginal cultural heritage place, but is yet to be assessed under Section 5 of the Aboriginal Heritage Act 1972.
- Historic: Aboriginal heritage places assessed as not meeting the criteria of Section 5 of the Aboriginal Heritage Act 1972. Includes places that no longer exist as a result of land use activities with existing approvals.

Place Type: The type of Aboriginal cultural heritage place. For example an artefact scatter place or engravings place.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place.

Coordinates

Map coordinates are based on the GDA 2020 Datum.

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Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
11816	DEVIL CREEK, MARDIE STATION	Yes	No	Yes	Men only	Register	Engraving; Grinding areas / Grooves	*Registered Knowledge Holder names available from DPLH	P00360

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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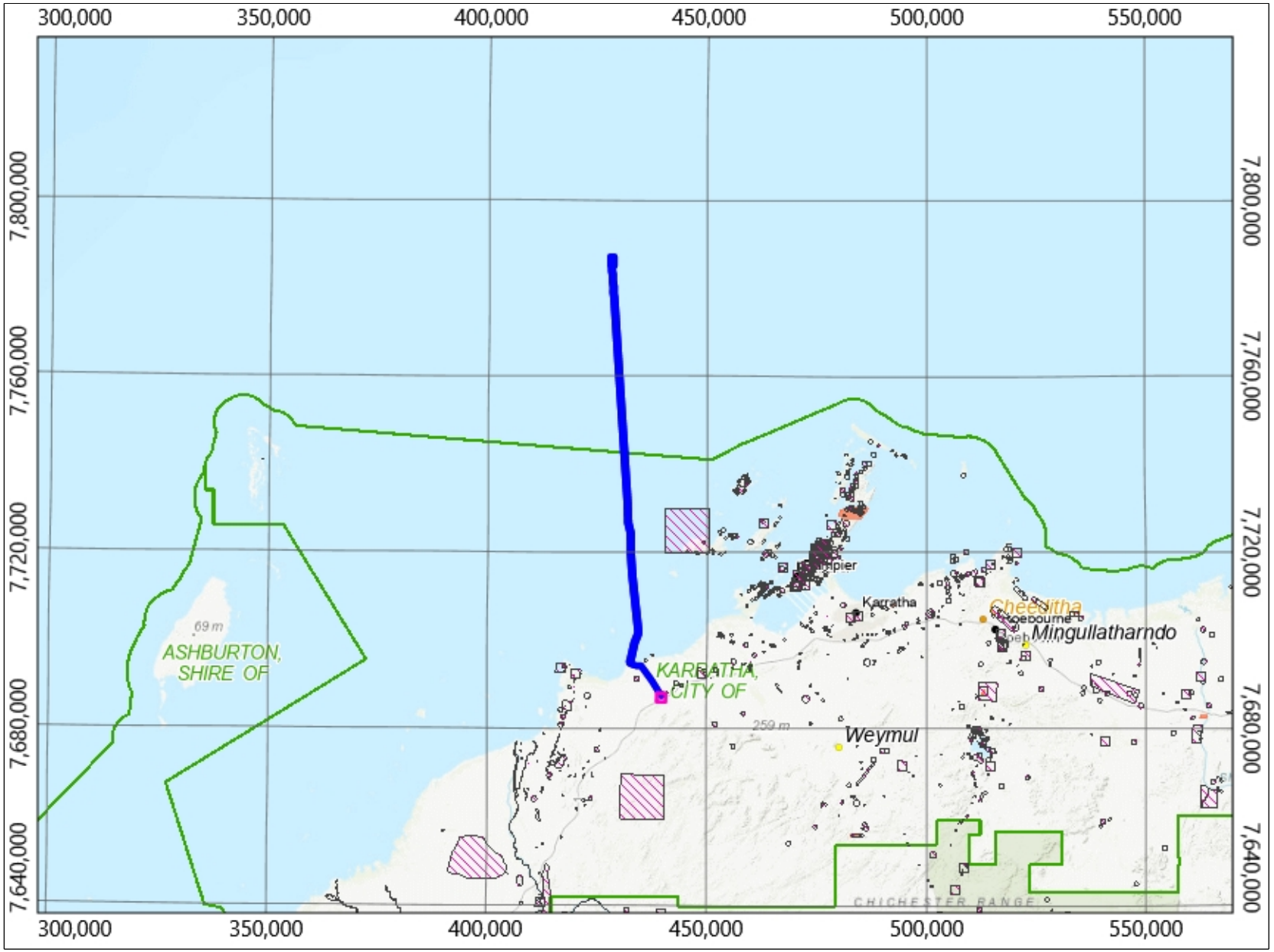

Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
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- Town
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46.50 kilometres

Map Scale 1 : 1,410,000

MGA Zone 50 (GDA2020)

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Aboriginal Cultural Heritage Inquiry System

List of Heritage Surveys

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Search Criteria

29 Heritage Surveys containing 30 Survey Areas in Shapefile - State EMBA Generalised

Disclaimer

Heritage Surveys have been mapped using information from the reports and / or other relevant data sources. Heritage Surveys consisting of small discrete areas may not be visible except at large scales. Reports shown may not be held at the Department of Planning, Lands and Heritage (DPLH). Please consult report holder for more information. Refer to https://www.wa.gov.au/organisation/department-of-planning-lands-and-heritage/aboriginal-heritage for information on requesting reports held by DPLH.

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Access

Some reports are restricted.

Spatial Accuracy

The following legend strictly applies to the spatial accuracy of heritage survey boundaries as captured by DPLH.

Very Good	Boundaries captured from surveyed titles, GPS (2001 onwards) submitted maps georeferenced to within 20m accuracy.
Good / Moderate	Boundaries captured from GPS (pre 2001) submitted maps georeferenced to within 250m accuracy.
Unreliable	Boundaries captured from submitted maps georeferenced to an accuracy exceeding 250m.
Indeterminate	Surveys submitted with insufficient information to allow boundary capture.

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Aboriginal Cultural Heritage Inquiry System

List of Heritage Surveys

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
17576	12304	Cultural responses to the Flandrian Transgression on the Montebello Islands, Northwest Australia	Manne, Tiina Helena		Archaeological	The survey area consists of the Noala Cave site (873), located in the Montebello archipelago. Survey area location and extent are as per the AHMS.	Unreliable	Field and Desktop
20099	12926	Report on an archaeological survey programme Barrow Island	Quartermaine G		Archaeological	The survey area encompasses the whole of Barrow Island, which is situated at a point off the Pilbara coast, 85km north of Onslow and 135km west of Dampier. Survey area and location is as per Figure 1.	Good	Field and Desktop
21597	15998	Desk top review and preliminary field investigations of Aboriginal Hertitage issues associated with the proposed Karratha and Port Hedland Heavy Industry Estates : April 1994.	Murphy, A ; Edwards, K ; Campell Smith, S		Archaeological	Karratha and Port Hedland Heavy Industry Estates. Brief survey	Moderate	Field and Desktop
21598	16400	A report of a preliminary Aboriginal Heritage Survey for the proposed Karratha Heavy Industry Project, Western Australia	Lantzke, D		Archaeological/ Ethnographic	Karratha Heavy Industry Project as shown in Figure 1.	Good	Field and Desktop
21993	19482	Draft :environmental impact statement / environmental review and management programme for the proposed Gorgon Development : executive summary	Gorgan Australian Gas		Archaeological/ Ethnographic	Gorgon Development	Unreliable	Field and Desktop
21994	19488	Draft :environmental impact statement / environmental review and management programme for the proposed Gorgon Development : main report volume i	Gorgan Australian Gas		Archaeological/ Ethnographic	Gorgon Development	Unreliable	Field and Desktop
21995	19497	Draft :environmental impact statement / environmental review and management programme for the proposed Gorgon Development : main report volume ii	Gorgan Australian Gas		Archaeological/ Ethnographic	Gorgon Development	Unreliable	Field and Desktop
21996	19504	Draft :environmental impact statement / environmental review and management programme for the proposed Gorgon Development : Technical appendices E1 - E3 social environment assessments	Gorgan Australian Gas		Archaeological/ Ethnographic	Gorgon Development :	Unreliable	Field and Desktop

Aboriginal Cultural Heritage Inquiry System

List of Heritage Surveys

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
22872	19386	Devil Creek Development Project (DCDP) : Consolidated Report on Aboriginal Heritage Surveys of the DCDP Areas	R & E O'Connor Pty Ltd		Archaeological	Apache Northwest gas pipeline, processing plant, ancillary infrastructure and access roads. Near Devil Creek, approximately 45 km SW of the town of Dampier in the Pilbara Region.		Field and Desktop
22954	19778	Report on a site identification survey for the Gorgon Project Pipeline & Construction Footprint on Barrow Island under the Aboriginal Heritage Act 1972 of the proposed Gorgon Project at Barrow Island, Western Australia	Australian Interaction Consultants		Archaeological/ Ethnographic	Pipeline Corridor, an LNG Plant, a Construction Village, Administration site, a Utilities site, and two Re-injection Drill Centres facilities on Barrow Island.		Field and Desktop
23084	17256	Kuruma Marthudunera Cultural Values in Relation to Licence Applications: L08 34, L08 35 & L08 36	Stevens, Robin		Archaeological/ Ethnographic	The study area lies within the Kuruma Marthudunera native title claim boundaries (WAG6090/98; WC99/012)	Moderate	Field and Desktop
23208	19212	Kuruma Marthudunera Ethnographic Survey 11-14 July 2008 Proposed Infrastructure Corridor and Port Area Citic Pacific Iron Ore Project Cape Preston	Kruse, Bill		Ethnographic	Proposed Infrastructure Corridor and Port Area Citic Pacific Iron Ore Project Cape Preston	Moderate	Field and Desktop
23556	16201	Archaeological Survey Report, Preston Island, Pilbara Region, WA	Czerwinski, Phil		Archaeological/ Ethnographic	Preston Island was surveyed on 11th June 2009.	Good	Field and Desktop
23571	19321	Section 18 Consultation Report with Yaburara & Mardudhunera People regarding Preston Island at Cape Preston, Western Australia : June 2009.	Lyneham, Alexandra		Ethnographic	Preston Island, Cape Preston, Western Australia		Field and Desktop
23714	19018	A Report of an Ethnographic Site Identification Heritage Survey and S18 Consultation: Priority Area 7 at Cape Preston in Tenement G08 052	Morgan, Stephen		Ethnographic	Tenement G08 052	Moderate	Field and Desktop
23813	19756	Archaeological Salvage Report Devil Creek Development Project Part B - Onshore Pipeline, Gas Plant and Ancillary Areas.	Corsini, Stephen.		Archaeological	Gas plant and associated infrastructure on part of Mardie Station pastoral lease, approx. 65km SW of Karratha		Field and Desktop
24183	17593	Ethnographic Survey and Consultation Report for YACMAC of the Iron Ore Holdings Limited, Cape Preston East Development at Cape Preston, Western Australia	Lafrentz, Damien		Ethnographic	Cape Preston East project area, south of Karratha, Western Australia.	Moderate	Field and Desktop

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
24185	17771	Archaeological Site Identification Survey Report of Iron Ore Holdings Limited Proposed Cape Preston East Project Section 2, south of Karratha, Western Australia : August 2013.	Fordyce, Ben		Archaeological	Section 2 of the Cape Preston East project area extends along the approximate 11km of haul road and associated infrastructure.	Good	Field and Desktop
24231	18633	Murujuga : Dynamics of Dreaming : Section 16 Research PLan	McDonald, Jo		Archaeological/ Ethnographic	The project is on the Pilbara coast of WA. Several sites were surveyed.	Indeterminate	Field and Desktop
27224	17602	Aboriginal Archaeological Assessment Proposed Barrow Island Infill Drilling Project - Conditional Section 18 Preliminary Archaeological Assessment - Barrow Island, Western Australia	RPS Group		Archaeological	Southern central position of the oilfield on Barrow Island, located approximately 95.0 km north-east of Onslow, Western Australia.	Good	Field and Desktop
102607	12930	A Report on Archaeological Work in the Coastal Pilbara, Western Australia. Final Report 1994.	Bradshaw, E.		Archaeological/ Ethnographic	The survey area consists of the coastal strip from the Maitland River to Balla Balla, including the Abydos and Onslow Coastal Plains, and the Dampier Archipelago. The exact extent of the survey area is unknown, but numerous sites have been registered: 900	Unreliable	Field and Desktop
102932	18661	A Survey for Aboriginal Sites: Dampier Salt Ltd Western Leases. 1978.	Bindon, P.		Archaeological	The survey area consists of the Dampier Salt Leases, as shown in figure 1.	Good	Field and Desktop
103078	12327	The Aboriginal Occupation of the Montebello Islands,Northwest Australia.	Veth, P.		Archaeological	The survey area consists of several islands of the Montebello archipelago, including Ah Chong, Alpha, Bluebell, Campbell, Delta, Hermite, North West, Primrose, South East and Trimouille. See Figure 1.	Good	Field and Desktop
103078	12362	The Aboriginal Occupation of the Montebello Islands,Northwest Australia.	Veth, P.		Archaeological	The survey area comprises of other islands in the Montebello archipelago, not including those in Survey Area 1 (SID1303).	Good	Field and Desktop

Aboriginal Cultural Heritage Inquiry System

List of Heritage Surveys

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
103188	12896	A Report on Archaeological Work in the Coastal Pilbara, Western Australia. Community Resource Document 1994.	Bradshaw, E.		Archaeological/ Ethnographic	The survey area consists of the coastal strip from the Maitland River to Balla Balla, including the Abydos and Onslow Coastal Plains, and the Dampier Archipelago. The exact extent of the survey area is unknown, but numerous sites have been registered: 900	Unreliable	Field and Desktop
105164	15432	Addendum to Report on an Ethnographic study of three sections of the expanded Dampier to Bunbury Gas Pipeline corridor	O'Connor, Rory.		Ethnographic	The survey area comprises Closed DIA sites 18089 and 18091	Indeterminate	Field and Desktop
105644	12713	Report on an Ethnographic Survey of the proposed Cape Preston Iron Ore Mine and treatment plant	O'Connor, Rory.		Ethnographic	The survey area consists of approximately 320sqkm of land encompassing a series of leases, which it is proposed will enclose three ore bodies, a treatment plant site and associated ancillary infrastructure, a services corridor and a port and jetty. Survey	Good	Field and Desktop
105645	12388	Report on an Archaeological Survey for Aboriginal Sites Cape Preston, Western Australia	McGann, Sally		Archaeological	The survey area consists of the proposed Cape Preston mine site and gas pipeline. Survey area location and extent are as per Figure 1.	Good	Field and Desktop
200066	19323	Aboriginal Heritage Site Identification Survey Report of The Chevron Australia Pty Ltd Proposed Gas Treatment Plant Additional Land, Barrow Island, Western Australia : March 2014 [TBD]	Fordyce, Ben ; Lafrentz, Damien		Archaeological/ Ethnographic	Aboriginal Heritage Site Identification Survey Report of The Chevron Australia Pty Ltd Proposed Gas Treatment Plant Additional Land, Barrow Island, Western Australia : March 2014 [TBD]		Field and Desktop
200067	19329	Aboriginal Heritage Archaeological Site Avoidance Survey Report of The Chevron Australia Pty Ltd Proposed Anode Bed Wells, Barrow Island, Western Australia : March 2014 [TBD]	Fordyce, Ben ; Lafrentz, Damien		Archaeological/ Ethnographic	Anode Bed Wells, Barrow Island, Western Australia : March 2014 [TBD]		Field and Desktop

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Heritage Survey Areas

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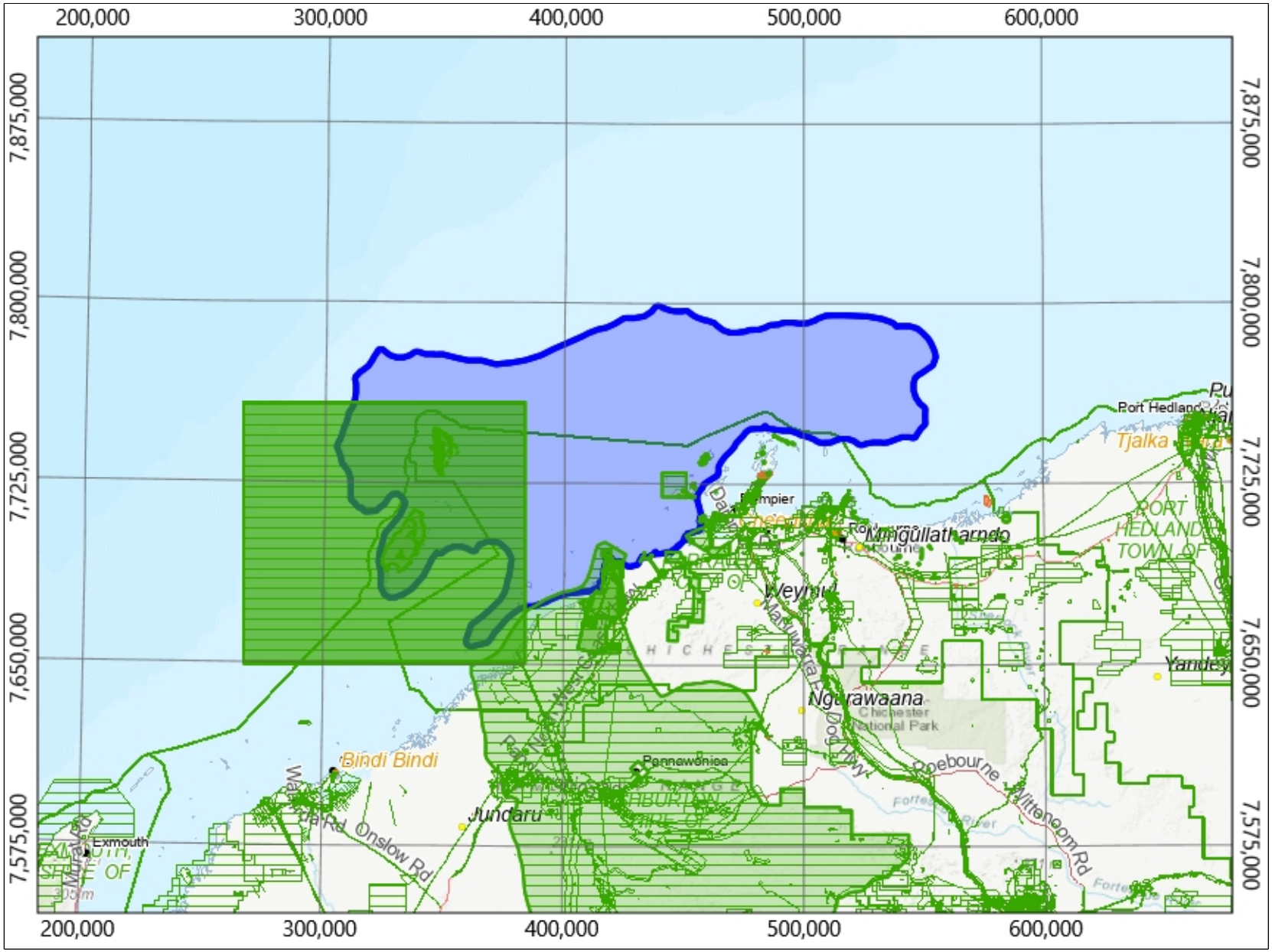

Legend

- Heritage Survey Area
- Search Area
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  - *Permanent*
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85.00 kilometres

Map Scale 1 : 2,580,000

MGA Zone 50 (GDA2020)

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Aboriginal Cultural Heritage Inquiry System

List of Heritage Surveys

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Search Criteria

21 Heritage Surveys containing 23 Survey Areas in Shapefile - ENVIRON_OFSHR_OPERATIONAL_AREAS

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Access

Some reports are restricted.

Spatial Accuracy

The following legend strictly applies to the spatial accuracy of heritage survey boundaries as captured by DPLH.

Very Good	Boundaries captured from surveyed titles, GPS (2001 onwards) submitted maps georeferenced to within 20m accuracy.
Good / Moderate	Boundaries captured from GPS (pre 2001) submitted maps georeferenced to within 250m accuracy.
Unreliable	Boundaries captured from submitted maps georeferenced to an accuracy exceeding 250m.
Indeterminate	Surveys submitted with insufficient information to allow boundary capture.

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
17059	13207	Dampier to Perth Natural Gas Pipeline Route: A Survey for Aboriginal Sites. March 1979.	Dept of Aboriginal Sites.		Archaeological/ Ethnographic	The survey area consists of the 1486km preferred route of the Dampier to Perth Natural Gas Pipeline. The survey extended from Dampier to Wagerup. The width of the survey corridor is not known. A default 5m width, either side of the centreline is assumed.	Unreliable	Field and Desktop
19019	18666	Summary report on Aboriginal heritage investigations proposed Dampier to Bunbury natural gas pipeline corridor widening project : prepared to assist the Aboriginal Cultural Material Committee	McDonald, Hales and Associates.		Archaeological/ Ethnographic	The survey area consists of an extension (widening) of the Dampier to Bunbury Natural Gas Pipeline corridor.	Good	Field and Desktop
19023	15500	Report on Aboriginal heritage investigations : proposed DBNGP pipeline corridor widening project	McDonald, Hales and Associates.		Archaeological/ Ethnographic	DBNGP pipeline corridor widening project. Widening on each side of existing easement and proposed deviations as shown in Fig. 1	Good	Field and Desktop
22869	17598	Devil Creek Development Project (DCDP) : Notice under Section 18 of the Aboriginal Heritage Act 1972	Apache Energy		Ethnographic	Devil Creek Development Project in the vicinity of Devil Creek approximately 65 km southwest of Karratha by road via the North West Coastal Highway.	Moderate	Field and Desktop
22870	20013	Consolidated Report of AIC Archaeological Heritage Surveys for Apache Northwest Pty Ltd proposed Devil Creek Development Project near Karratha, Western Australia	Australian Interaction Consultants		Archaeological	Devil Creek Development Project near Karratha, Western Australia		Field and Desktop
22871	20021	Consolidated Report of AIC Ethnographic Heritage Surveys for Apache Northwest Pty Ltd Proposed Devil Creek Cevelopment Project near Karratha, Western Australia	Australian Interaction Consultants		Ethnographic	Project near Karratha, Western Australia		Field and Desktop
22872	19386	Devil Creek Development Project (DCDP) : Consolidated Report on Aboriginal Heritage Surveys of the DCDP Areas	R & E O'Connor Pty Ltd		Archaeological	Apache Northwest gas pipeline, processing plant, ancillary infrastructure and access roads. Near Devil Creek, approximately 45 km SW of the town of Dampier in the Pilbara Region.		Field and Desktop

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
23813	19756	Archaeological Salvage Report Devil Creek Development Project Part B - Onshore Pipeline, Gas Plant and Ancillary Areas.	Corsini, Stephen.		Archaeological	Gas plant and associated infrastructure on part of Mardie Station pastoral lease, approx. 65km SW of Karratha		Field and Desktop
27377	19191	YACMAC Work Program Clearance Survey Report of Iron Ore Holdings Proposed Maitland River Project, E47/1537 & E47/2372 RC Phase 2 Drilling Program, Pilbara, WA	Lafrentz, Damien		Archaeological/ Ethnographic	Proposed Maitland River Project, E47/1537 & E47/2372 RC Phase 2 Drilling Program, Pilbara, WA.	Moderate	Field and Desktop
28215	18252	Heritage Monitoring Report of Aboriginal Sites within Loop 0 of DBNGP Stage 5B, Karratha Station to Mardie Station, WA : volume i	Australian Interaction Consultants		Archaeological	A looping section of the Dampier to Bunbury Natural Gas Pipeline from south of Dampier to Mardie Station, Western Australia.	Moderate	Field and Desktop
28216	19765	Heritage Monitoring Report of Aboriginal Sites within Loop 0 of DBNGP Stage 5B, Karratha Station to Mardie Station, WA : volume ii	Australian Interaction Consultants		Archaeological	A looping section of the Dampier to Bunbury Natural Gas Pipeline from south of Dampier to Mardie Station, Western Australia.		Field and Desktop
101843	12366	Report on an Archaeological Survey for Aboriginal Sites Stag Deveopment Project, Karratha. March 1997.	Quartermaine G S		Archaeological	The survey area consists of a proposed facilities area measuring 150m x 150m, located at Noorea Point behind the coastal strip. Survey area location is as per Figure 3a.	Very Good	Field and Desktop
101843	12306	Report on an Archaeological Survey for Aboriginal Sites Stag Deveopment Project, Karratha. March 1997.	Quartermaine G S		Archaeological	The survey area consists of an 8.5km long road reserve from the North West Coastal Highway to the proposed facilities area (SA 2), and a proposed 2.5km long road reserve running parallel to the coast and along the border of Mardi Station and vacant Crown	Very Good	Field and Desktop
101843	12415	Report on an Archaeological Survey for Aboriginal Sites Stag Deveopment Project, Karratha. March 1997.	Quartermaine G S		Archaeological	The surveay area consists of a proposed 2.5km long pipe fabrication corridor running south west from the facilities site (SA 2), and includes a pipe ramp to the ocean. A corridor of 70m was surveyed. Survey area location is as per Figure 3a.	Very Good	Field and Desktop

Aboriginal Cultural Heritage Inquiry System

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
101846	11822	Arch.Survey Dampier-Perth Nat.Pipeline Section 1: Burrup Peninsula-Yannarie R. Supp.Report 1:Access Roads & Con.Sites.	Pickering, M.		Archaeological	The survey area consists of approximately 130km of access roads and 18 construction sites associated with Section 1 of the DPNGP. See page 2 for a list of the locations of the construction sites. The dimensions of the construction sites are not known. The	Indeterminate	Field and Desktop
101856	17211	An archaeological Survey of the Dampier-Perth Natural Gas Pipeline Section 1 : Burrup Peninsula-Yannarie River	Pickering, M.		Archaeological	The survey area consists of section 1 of the Dampier to Perth natural gas pipeline route, Burrup Peninsula to Yannarie River; between SF 50-2, 4880.4240; and SF 50-13, 2910.1280. See map inserts.	Unreliable	Field and Desktop
102432	12281	Report on an Ethnographic Survey of a Pipeline Facility in the Karratha and Mardie Stations District. March 1997.	O'Connor, R.		Ethnographic	The survey area consists of a proposed access road, surveyed to 50m either side of the centreline; a proposed fabrication corridor, measuring 2.5km in length and 0.07km in width; a facility area, measuring 150m x 150m and located adjacent to the northern	Very Good	Field and Desktop
102607	12930	A Report on Archaeological Work in the Coastal Pilbara, Western Australia. Final Report 1994.	Bradshaw, E.		Archaeological/ Ethnographic	The survey area consists of the coastal strip from the Maitland River to Balla Balla, including the Abydos and Onslow Coastal Plains, and the Dampier Archipelago. The exact extent of the survey area is unknown, but numerous sites have been registered: 900	Unreliable	Field and Desktop
103187	18455	Survey of Access Roads and Construction Sites - Dampier to Perth Gas Pipeline Project.	Pickering, M.		Archaeological	The area between the Dampier Archipelago and the Vermin Proof fence, South on the Murchison River.	Moderate	Field and Desktop

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Survey Report ID	Survey Area ID	Report Title	Report Authors	Survey Program	Survey Type	Area Description	Spatial Accuracy	Field / Desktop
103188	12896	A Report on Archaeological Work in the Coastal Pilbara, Western Australia. Community Resource Document 1994.	Bradshaw, E.		Archaeological/ Ethnographic	The survey area consists of the coastal strip from the Maitland River to Balla Balla, including the Abydos and Onslow Coastal Plains, and the Dampier Archipelago. The exact extent of the survey area is unknown, but numerous sites have been registered: 900	Unreliable	Field and Desktop
105164	15432	Addendum to Report on an Ethnographic study of three sections of the expanded Dampier to Bunbury Gas Pipeline corridor	O'Connor, Rory.		Ethnographic	The survey area comprises Closed DIA sites 18089 and 18091	Indeterminate	Field and Desktop
105175	13443	Report on an ethnographic study of three sections of the expanded Dampier to Bunbury Gas Pipeline corridor	O'Connor, Rory.		Ethnographic	The survey area comprises the proposed expanded Dampier to Bunbury gas pipeline corridor, particularly those sections which lie within the native title claim applications of the Wong-Goo-Tt-Oo, Mullewa Wadjari and Franks Claimants. The width of the corrid	Good	Field and Desktop
105283	12590	Site identification survey under the Aboriginal Heritage Act (1972) of the proposed increase in width of the Dampier to Bunbury natural gas pipeline route from MLV 7 to Peter Creek in the Pilbara region of Western Australia	Parker, Ronald T		Ethnographic	The survey area consists of an extension of the width of the Dampier to Bunbury Gas Pipeline route from 30m to 100m. The portion of the corridor surveyed is located between MLV7 and Peter Creek. Survey area location and extent are indicated in Appendix C.	Good	Field and Desktop

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Heritage Survey Areas

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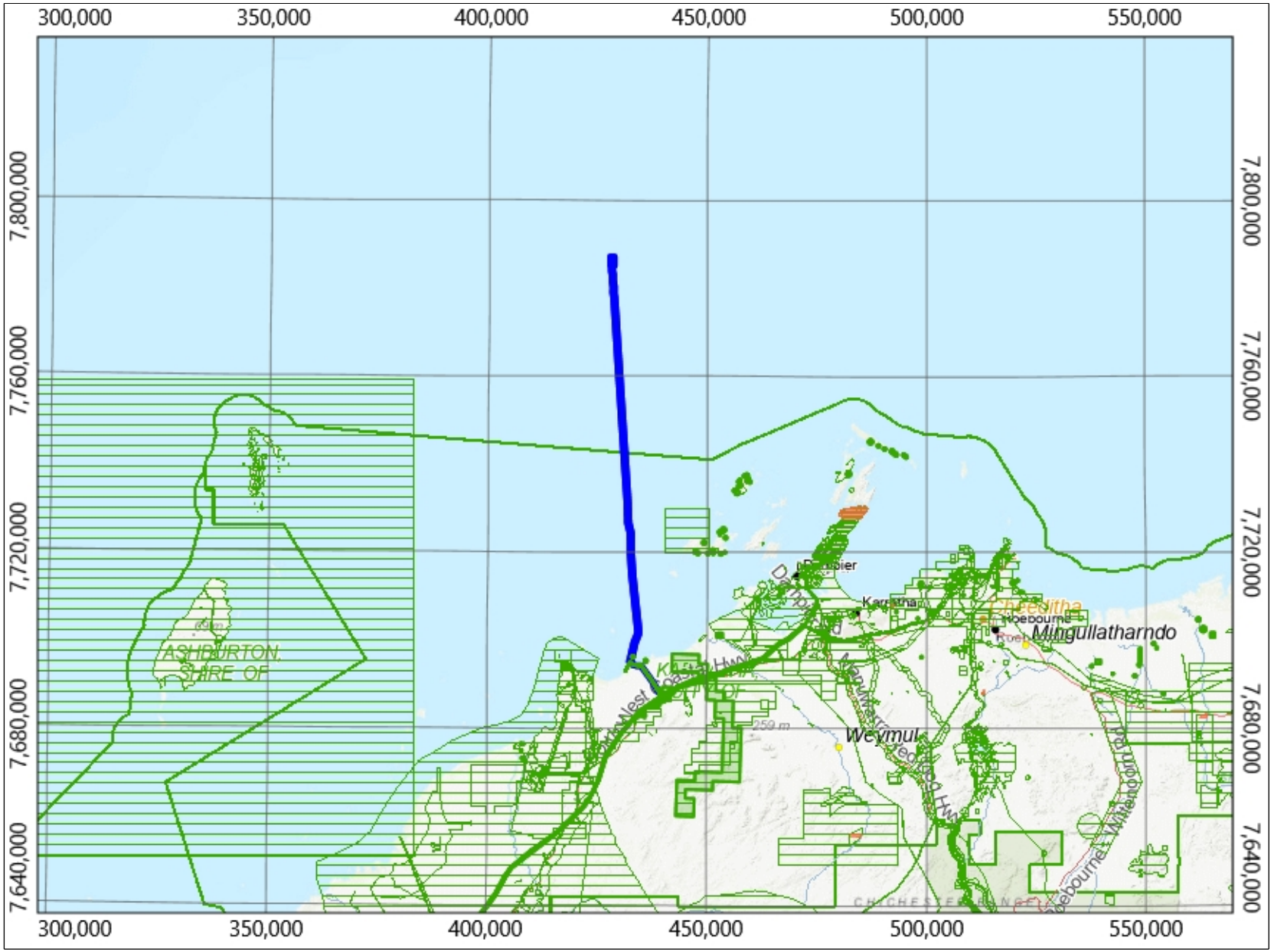

Legend

- Heritage Survey Area
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

46.50 kilometres

Map Scale 1 : 1,410,000

MGA Zone 50 (GDA2020)

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Appendix F Evidence of environment plan consultation

Fact sheets

Information for relevant persons

Santos

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan

Activity Overview

Santos operates the onshore Devil Creek Gas Plant (DCGP), located approximately 10 km inland from Gnoorea Point and 45 km south west of Karratha, Western Australia (WA). Hydrocarbons are transported to the DCGP from the offshore Reindeer Field via the Devil Creek Gas Supply Pipeline (DCG Supply Pipeline) and to the Dampier to Bunbury Natural Gas Pipeline (DBNGP) via the Devil Creek Sales Gas Pipeline (DC Sales Gas Pipeline).

The section of the DCG Supply Pipeline in WA state jurisdiction and the DC Sales Gas Pipeline are collectively referred to as the Devil Creek Facilities (**Figure 1**).

The offshore Reindeer Field is proposed to continue operations whilst there are sufficient hydrocarbons. However, the Reindeer field is now approaching end of field life, at which time production will cease at the Reindeer Well Head Platform (WHP). Following cessation of production, the DCG Supply Pipeline will be put into preservation under a revision to the existing in-force Operations Environment Plan.

This will take place ahead of a future decision on whether to proceed with decommissioning or to re-purpose the DCG Supply Pipeline for Carbon Capture and Storage (CCS) at the depleted Reindeer Field. Activities planned during the operations and preservation phase are outlined on Page 2 and typically include infrequent and short duration vessel and land-based inspection, monitoring, maintenance and repair (IMMR) activities.

If the CCS project proceeds, the DCG Supply Pipeline will be brought back into services to transport CO_2 for storage, rather than being decommissioned. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.

Consultation and Feedback

All petroleum activities in WA land and waters must have an Environment Plan (EP) accepted by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) before any activities can take place.

Under WA government regulations, Santos is required to consult with relevant authorities and other relevant interested persons and organisations that may be affected by proposed activities. Input from relevant authorities, persons and organisations is used for the development of EPs, which are then assessed by DEMIRS.

Santos meets this requirement by undertaking consultation in two phases:

- **Preliminary consultation** to understand values and sensitivities and confirm consultation expectations of relevant persons; and
- **Consultation** of relevant persons on the specific activities.

This factsheet has been issued to support preliminary consultation for the five-year revisions of the Operations EPs and updates to include cessation of production activities. Activity specific consultation is planned to commence on **28 June 2024**, with the consultation period closing on **29 July 2024**. More details on consultation and providing feedback can be found on the back page of this factsheet.

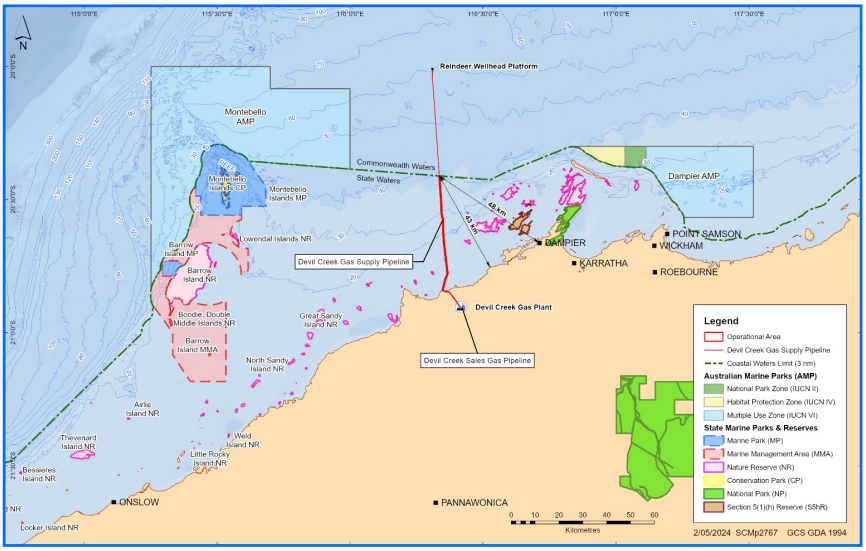

Figure 1. *Devil Creek facilities activity location.*

Activity Description

Activity details	
Timing	The DCG Supply Pipeline and DC Sales Gas Pipeline are currently producing in the operations phase and are anticipated to enter a cessation of production (preservation phase) between 2024 and 2026, subject to matters such as field performance and economics.
Duration	The duration of ongoing operations and the timing of cessation of production (preservation phase) will be dependent on Santos' decision-making for decommissioning or re-purposing the DCG Supply Pipeline for CCS. A 5-year EP is being sought from DEMIRS, which will include both operations and cessation of production phases of the activity.
Water depth	The water depth is approximately 38 m at the deepest point at the Commonwealth/ State boundary.

Planned activities	**Operations phase activities:**
	• Transportation of hydrocarbons from the Reindeer Field through the DCG Gas Supply Pipeline to the DCGP, and then through the DC Sales Gas Pipeline to the DBNGP.
	• Suspension of operations activities (prior to cessation of production) including, flushing and purging the pipelines and process equipment of any residual hydrocarbons.
	• Pipeline IMMR, including activities such as:
	  • Pipeline and pipeline corridor inspection (e.g pigging and other integrity inspections and surveys), maintenance, modification, removal, repair, replacement
	  • Marine growth/debris removal and corrosion control
	  • Cathodic protection monitoring and integrity inspections
	  • Onshore pipeline corridor IMMR, vegetation clearance, and associated sediment disturbance
	  • environmental monitoring/sampling (e.g. sediment sampling)
	
	Cessation of Production (Preservation Phase) activities:
	• The pipelines will remain filled with treated seawater or gas
	• Pipeline and pipeline corridor inspection, maintenance, modification, removal, repair, replacement including activities such as:
	  • Pipeline and pipeline corridor inspection (e.g pigging and other integrity inspections and surveys), maintenance, modification, removal, repair, replacement
	  • Marine growth/debris removal and corrosion control
	  • Cathodic protection monitoring and integrity inspections
	  • Onshore pipeline corridor IMMR, vegetation clearance, and associated sediment disturbance
	  • environmental monitoring/sampling (e.g. sediment sampling)

Vessels	Typically, a single vessel would be used to conduct IMMR activities during the life of the EP. However, depending on the nature and location of a repair activity, additional vessels may be required.
Aircraft	No use of aircraft is required for activities associated with the DCG Supply Pipeline.

Description of the natural environment	**Offshore**
	• The operational area does not intercept any marine protected areas, the closest being the Montebello Australian Marine Park (AMP) and the Dampier AMP, which are located approximately 37 km and 56 km respectively from the nearest boundary of the operational area.
	• The seabed of the operational area is mostly soft sediments that support sparse benthic (living on the seafloor) and epibenthic (living on the surface of sediments) organisms such as infauna (living within the sediment). Habitats include submerged hard substrate such as pavement and high relief reef areas that provide attachment points for sessile epifauna as well as perches and hiding places for mobile epifauna. The operational area also contains small patches of macroalgae and as well as small seagrass.
	• The operational area includes Biologically Important Areas (BIAs) for protected marine species that include seabirds, whales, turtles and sharks.
	• No Key Ecological Features (KEFs) intercept the operational area associated with the DCG Supply Pipeline corridor. The closest KEFs to the operational area are the Ancient Coastline at 125 m Depth Contour (located 89 km north from the closest edge of the operational area), and Glomar Shoals (79 km north-east), both of which are not overlapped by the Environment that May Be Affected (EMBA) or the operational area.
	Onshore
	• The DCGP onshore pipelines reside within the Littoral, Cheerawarra and Horsefalt land systems, which are defined as coastal mudflats, clay plains and sandy coastal plains. Shoreline habitat types found within the regional area include mangroves, sandy beaches, intertidal and subtidal zones and rocky shorelines.
	• Vegetation within the onshore operational area includes two communities that are on the WA list of priority ecological communities (PECs):
	  • Roebourne Plains coastal grassland with gilgai microrelief on deep cracking clays; and
	  • Stony Chenopod associations of the Roebourne Plains.

Operational Area	The operational area is defined as: • An area 250 m either side of the State waters section of the DCG Supply Pipeline (from the State waters limit to the shoreline line at Gnoorea Point); • An area 50 m buffer either side of the onshore section of the DCG Supply Pipeline (from Gnoorea Point to the DCGP); and • An area 50 m buffer either side of the DC Sales Gas Pipeline (from the DCGP to the DBNGP).
Exclusion zone	No exclusion zones are associated with either the DCG Supply Pipeline or the DC Sales Gas Pipeline.
Petroleum production licences	Pipeline Licence TPL/20 (DCG Supply Pipeline - State waters component) Pipeline Licence PL81 (DCG Supply Pipeline onshore component) Pipeline Licence PL86 (DC Sales Gas Pipeline between DCGP and DBNGP)

Activity Purpose and Approvals

Image 1. *Typical vessel used for IMMR activities.*

The in-force *Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (Onshore and State Waters)* details the environmental management measures implemented by Santos for operation of the DCG Supply Pipeline and DC Sales Gas Pipeline.

Activities proposed to be managed under a revision of the EP are described in the Activity Description table in the previous section.

The preservation phase will begin when the offshore Reindeer Facility is no longer producing, and the DCG Supply Pipeline has been flushed, cleaned and then filled with a preservation product to preserve the pipeline ahead of a future decision on decommissioning or CCS.

Vessel-related activities will be undertaken during operations and preservation phases.

IMMR activities conducted on the DCG Supply Pipeline will be infrequent and of relatively short duration. Inspections will generally involve a vessel travelling along the route of the pipeline using towed acoustic instruments or may involve using a Remotely Operated Vehicle (ROV) launched and recovered from the vessel. Typically, vessels will be within the Operational Area for approximately 30 days per year depending on the IMMR requirements.

The *Petroleum Pipelines (Environment) Regulations 2012* (WA) and *Petroleum (Submerged Lands) (Environment) Regulations 2012 (WA)* require a licence holder to have an EP accepted by DEMIRS before any petroleum activity can commence. An accepted revision of the Operations EP must be in place to enable the cessation of pipeline operations.

Defining the Environment Area for Proposed Activities

Santos has undertaken an initial assessment to identify the environmental, social, economic, and cultural values and sensitivities that may be affected by impacts and risks of proposed activities.

To do this we have considered the totality of the areas where activity impacts and risks may occur.

These areas are summarised in **Table 1**. The widest extent of these areas is called the Environment that May Be Affected (EMBA), which for this activity is the combined EMBA for the modelled potential worst-case hydrocarbon spill scenarios (rupture of the DCG Supply Pipeline and vessel collision releasing marine diesel oil at the sea surface). The consolidated EMBA is illustrated in **Figure 2**.

Oil spill EMBAs are defined by overlaying a great number (usually hundreds) of individual, computer simulated, hypothetical hydrocarbon spill events into a single map. Each simulation run starts from the same location (release point) but each run will be subject to a different set of wind and weather conditions derived from historical data. The use of advanced and sophisticated models enables us to present all the areas that could be affected.

While the modelled EMBA represents the theoretical spatial extent that could be contacted by the worst-case spill event(s), an actual spill event is more accurately represented by a single simulation run, resulting in a much smaller spatial extent impacted by the spill.

Often, one or more simulation runs are selected to be representative of the 'worst-case' based on the nature and scale of the activity and the local environment.

Please see the **NOPSEMA Spill Modelling Video** for more information on oil spill modelling and why it is required for the preparation of EPs

It is noted that there is no EMBA developed in this manner for the onshore pipeline component. Rather, the Operational Area within which the planned activities occur has been used to identify relevant persons.

Table 1. *Environment area for proposed activities*

Environment Area
Operational Area Operational area for the DCG Supply Pipeline and DC Sales Gas Pipeline Operations EP (Onshore and State waters) is as per the current operations and is defined as: • An area 250 m either side of the State waters section of the DCG Supply Pipeline (from the State waters limit to the shoreline line at Gnoorea Point); • An area 50 m either side of the onshore section of the DCG Supply Pipeline (from Gnoorea Point to the DCGP); and • An area 50 m either side of the DC Sales Gas Pipeline (from the DCGP to the DBNGP).
Environment that May Be Affected (EMBA)
The spatial extent of activity impacts (e.g., light, noise) and risk (e.g. hydrocarbon spill).

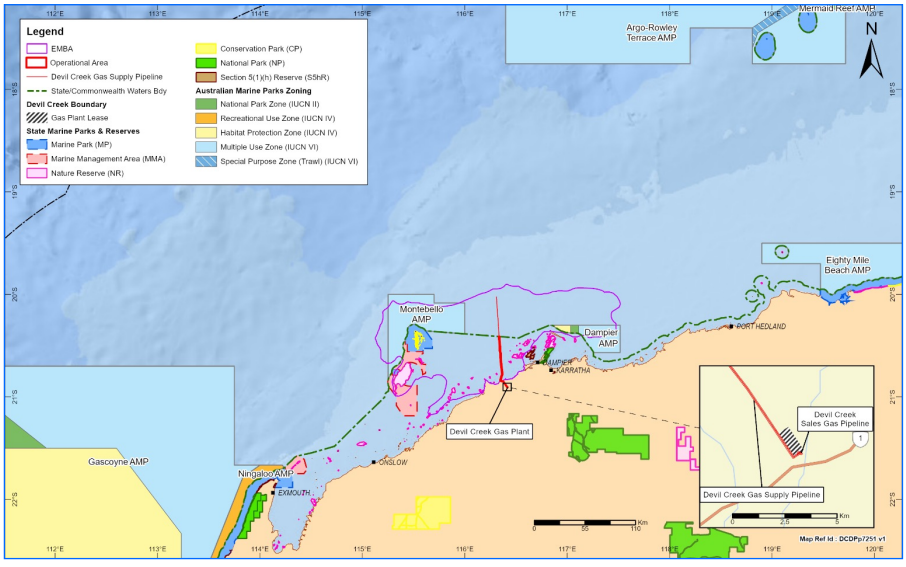

Figure 2. *Operational Area and EMBA.*

Santos has undertaken a review of publicly available information to identify environmental, social, economic, and cultural features and/or values that may be affected by activity impacts and risks. The outcomes of this review are summarised in **Table 2**.

Table 2. Environmental, social, economic and cultural features

Feature	Description	Within Operational Area	Within EMBA	Public Information Review
Aboriginal Heritage	Registered Aboriginal heritage sites protected under the: • *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) • *Aboriginal Heritage Act 1972* (WA)	No	Yes	Barrow Island, Montebello Islands, Dampier Archipelago, fand the adjacent foreshores have a long history of occupancy by Indigenous communities. A single National Heritage place (Dampier Archipelago, including Burrup Peninsula) is located 12 km from the operational area. There is one registered Aboriginal Heritage site (*Aboriginal Heritage Act 1972* (WA)) within the operational area. However, the EMBA overlaps with 55 registered Aboriginal Heritage sites and 41 lodged Aboriginal Heritage sites.
Biologically Important Areas	Biologically important areas (BIAs) are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration.	Yes	Yes	The operational area includes Biologically Important Areas (BIAs) for protected marine species that include seabirds, whales, turtles and sharks.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Cultural Heritage	Registered cultural sites under the: • *Underwater Cultural Heritage Act 2018* (Cth) • *Maritime Archaeology Act 1973* (WA)	No	Yes	There are no known sites of shipwrecks, sunken aircraft or other types of underwater cultural heritage within the operational area. The closest known historic shipwreck is the Dampier which is located approximately 10.7 km west of the operational area (located within the EMBA). Little is known about the history of this wreck. There are a total of 11 known shipwrecks located within the EMBA.
Defence	Designated defence activity areas	No	Yes	The operational area does not intersect any designated defence activity areas, however the EMBA overlaps with the North-Western Exercise Area (NWXA).
Energy Industry	Petroleum and Carbon Capture and Storage activities	No	Yes	Several offshore petroleum projects and exploration activity is present within the region.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Fishing	Commercial fishing	Yes	Yes	Several WA and Commonwealth managed fisheries overlap the operational area and EMBA. Three Commonwealth fisheries overlap the operational area: the Western Tuna and Billfish Fishery, the Southern Bluefin Tuna Fishery, and the Western Skipjack Tuna Fishery. WA state managed fisheries active within the operational area include the Pilbara Fish Trawl (interim) Managed Fisheries, Nickol Bay Prawn Managed Fishery, Mackerel Managed Fishery, Marine Aquarium Fish Managed Fishery and the Specimen Shell Managed Fishery.
	Indigenous, subsistence or customary fishing	Yes	Yes	Traditional Australian Indigenous fishing in WA waters predominately occurs within inshore tidal waters and there is likely to be traditional fishing occurring within the nearshore operational area and in the surrounding EMBA.
	Recreational fishing	Yes	Yes	Recreational fishing may occur within the operational area and is known to occur within the EMBA.
Key Ecological Features	Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity.	No	No	No KEFs intercept the operational area associated with the DCG Supply Pipeline corridor. The closest KEFs to the operational area are the Ancient Coastline at 125 m Depth Contour (located 89 km north from the closest edge of the operational area), and Glomar Shoals (79 km north-east), both of which are not overlapped by the EMBA or the operational area. The operational area does not intersect any threatened ecological communities.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Protected Areas (nearest Commonwealth and Territory)	Australian Marine Park (AMP)	No	Yes	The operational area does not intercept any marine protected areas. The closest protected areas are the Montebello Australian Marine Park (AMP) and the Dampier AMP, which are located approximately 37 km and 56 km respectively from the nearest boundary of the operational area. The EMBA overlaps both these AMPs.
	Western Australian Marine Parks and Marine Management Areas	No	Yes	There are no Western Australian Marine Parks or Marine Management Areas located within the operational area. The EMBA overlaps the following WA State Marine Parks and Marine Management Areas: • Montebello Islands Marine Park. • Barrow Island Marine Park. • Barrow Island Marine Management Area.
Shipping	Shipping routes	Yes	Yes	The DCG Supply Pipeline resides between two shipping fairways. The first runs parallel to the offshore pipeline approximately 20 km to the east. The other crosses the offshore pipeline at approximately 57 km from the mean low water mark and runs in a south-west to northeast direction. Additional shipping routes are located within the wider region, and it is expected that local vessel traffic will pass through the area.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Tourism	Marine and coastal tourism	Yes	Yes	A number of tourism activities are known to occur within the operational area and EMBA. These are primarily associated with the Montebello AMP, Dampier AMP and Eighty Mile Beach Marine Park. Specific tourism activities in these areas include recreational diving, fishing, snorkelling, cruises and the Gnoorea Point Campground.
Towns / Communities	Dampier	No	No	Dampier is the nearest town and is approximately 48 km southeast of the operational area at the Commonwealth/ State boundary and 40 km northeast of the sales gas pipeline at the DCGP.

We have summarised in **Table 3** the potential environmental impacts risks and associated management measures for the proposed activity. These aspects will be risk-assessed within the EP on a case-by-case basis.

Table 3. Activity impacts and risk management

Potential activity impacts	
Interaction with terrestrial fauna and flora	
Description of risks During the operational life of the activity, planned interactions with terrestrial fauna and flora may occur from the following activities: • Non-routine, but planned, excavations within the onshore component of the operational area. • Non-routine, but planned, vegetation clearing within the onshore component of the operational area.	**Compliance with the following key management measures** • Obtain a native vegetation clearing permit if required. • Project execution plan for excavation activities and vegetation clearing related to that excavation activity. • Management of excavation activities.
Acoustic disturbance to fauna	
Description of risks Potential impacts from noise emissions may occur from the following sources: • IMMR activities of the subsea infrastructure (e.g., use of ROV, single beam echo sounder (SBES), multibeam echo sounder (MBES), sidecan sonar (SSS), autonomous underwater vehicle (AUV), diving operations marine growth cleaning, pigging, modification and replacement of components). • Support vessel activities during IMMR activities (e.g., vessel engines, thrusters and other machinery). • Onshore drones or land-based vehicles.	**Compliance with the following key management measures** • Procedure for interacting with marine fauna incorporating the requirements of Environment Protection of Biodiversity Conservation Act (EPBC) Regulations (Part 8) for interacting with cetaceans. • Prestart Requirements.

Table 3. Activity impacts and risk management ... continued

Light emissions	
Description of risks	**Compliance with the following key management measures**
Light emissions in the marine environment will occur as a result of: • Safety and navigational lighting. • ROV operational lights. • No nighttime maintenance/operations activities are planned for the onshore section of the pipelines but may be required for emergency work. There are no lights along the onshore gas supply pipeline, so there is no light glow on Forty Mile Beach.	• Lighting will be used as required, for safe work conditions and to meet navigational requirements. • Premobilisation review and planning of lighting on vessels prior to IMMR activities commencing.
Atmospheric emissions	
Description of risks	**Compliance with the following key management measures**
Potential impacts from atmospheric emissions may occur in the operational area due to the following operations: • Combustion emissions from support vessel operations. • Accidental release of ozone-depleting substances in closed-system rechargeable refrigeration systems. • High pressure blasting (garnet or a similar product) of the onshore section of the pipeline (if an area needed to be excavated) for IMMR activities resulting in the release of particulate matter to the air.	• Vessel's planned maintenance system. • Fuel oil quality meets The International Convention for the Prevention of Pollution from Ships MARPOL requirements. • International Air Pollution Prevention Certification (IAPP). • Waste incineration management.

Table 3. Activity impacts and risk management ... continued

Seabed and benthic habitat disturbance	
Description of risks Disturbance to the seabed and benthic habitats could potentially occur as a result of the following activities: • Vessel anchoring (non-routine). • Cleaning of subsea infrastructure. • Sedimentation as infrastructure is placed or relocated on the seabed for operational requirements or IMMR activities. • Temporary subsea storage of equipment (e.g., ROV basket or clump weight). • Subsea maintenance and repair activities (e.g., diving, drone survey activities, ROV operations, cutting, welding, pigging, installation, replacement or modification of subsea equipment, freespan rectification and stabilisation etc.). • Creation of artificial habitat because of the physical presence of infrastructure (and from currents altered by the presence of subsea infrastructure).	**Compliance with the following key management measures** • Planned subsea and offshore maintenance. • Dropped object prevention procedures. • Dropped object recovery. • Anchoring and equipment deployment management.

Table 3. Activity impacts and risk management ... continued

Physical presence and interaction with other users	
Description of risks Potential interactions with other users may occur as a result of: • Pipeline maintenance works (may affect visual amenity and vehicle traffic). • Vessels supporting offshore pipeline operations. • The onshore section of the DCGP is buried parallel to a public access road (Forty Mile Beach Road). Interactions with terrestrial users in the operational area are unplanned.	**Compliance with the following key management measures** • Navigational charting of infrastructure. • Navigational lighting and aids. • Seafarer certification. • Constant bridge watch on support vessels. • Stakeholder consultation.
Operational discharges	
Description of risks Planned discharges from vessels to the marine environment include: • Deck drainage. • Cooling water. • Bilge water. • Ballast water. • Desalination brine. Other discharges associated with planned maintenance and operations include: • Discharges from cathodic protection systems on subsea pipelines. • Discharges from maintenance activities (e.g., releases during repair of infrastructure, leak testing, fabric maintenance). • Paint and chemicals from cleaning, inspection and repair of infrastructure and pipeline. • These volumes are small, residual amounts and are not measurable.	**Compliance with the following key management measures** • Sewage treatment system. • Oily water treatment system. • Waste (garbage) management plan. • Deck cleaning product selection procedure. • Chemical selection procedure. • Pipeline flushing prior to opening of the subsea system.

Table 3. Activity impacts and risk management ... continued

Potential activity risks	
Unplanned introduction of invasive marine species (IMS)	
Description of risks Introduction of invasive marine species (IMS) may occur due to: • Biofouling on vessels and external/internal niches (such as sea chests, seawater systems). • Biofouling on equipment that is routinely submerged in water (such as ROVs). • Discharge of high-risk ballast water. • Cross-contamination between vessels.	**Compliance with the following key management measures** • Implementation of the management controls in the Santos Invasive Marine Species Management Plan (IMSMP). • Anti-foulant system. • Ballast water management plan.
Unplanned interaction with marine fauna	
Description of risks There is the potential for vessels or equipment (e.g., ROV) involved in operational activities to interact with marine fauna, including potential strike or collision potentially resulting in severe injury or mortality. Fauna strike may also occur from drone collision, during take-off and landing.	**Compliance with the following key management measures** • Constant bridge watch on support vessels. • Procedure for interacting with marine fauna. • Constant bridge watch. • Marine fauna protection available on the vessel for use on ROV.
Unplanned release of solid objects	
Description of risks Solid objects, such as those listed below, can be accidentally released to the marine environment, and potentially impact on sensitive receptors: • Non-hazardous solid wastes, e.g., paper, plastics and packaging. • Hazardous solid wastes, e.g., batteries, fluorescent tubes, medical wastes, and aerosol cans. • Equipment and materials, e.g., hard hats, tools or infrastructure parts.	**Compliance with the following key management measures** • Vessels Planned Maintenance System. • Dropped Object Prevention Procedure. • Garbage management. • Dropped Object Recovery.

Table 3. Activity impacts and risk management ... continued

Unplanned hazardous liquid release to the marine environment (non-hydrocarbon)	
Description of risks	**Compliance with the following key management measures**
Causes for accidental liquid releases (other than diesel and condensate spills) include: • Transferring, storing or using bulk products. • Mechanical failure of equipment. • Hose or hose connection failure or leak. • Lifting – dropped objects damaging liquid vessels (containers). • ROV operations.	• Dropped object prevention procedure. • Hazardous Chemical Management Procedure. • General Chemical Management Procedure. • Refuelling and chemical transfer procedure. • Vessel spill response plans [Shipboard Oil Pollution Emergency Plan (SOPEP) / Shipboard Marine Pollution Emergency Plan (SMPEP)]. • ROV inspection and maintenance procedures.
Unplanned subsurface release of treated seawater from the DCG Supply Pipeline	
Description of risks	**Compliance with the following key management measures**
Unplanned release of seawater treated with oxygen scavenger and biocide (preservation fluid) may occur as a result of: • Pipeline rupture caused by an integrity or corrosion issue, dropped object or anchor drag. • The maximum credible spill scenario as a result of a full pipeline rupture is the release of approximately 13,000 m^3 of preservation fluid.	• DEMIRS accepted safety case. • Planned subsea and offshore maintenance. • Inspection and corrosion monitoring. • Navigational charting of infrastructure. • Anchoring and equipment deployment management.
Unplanned terrestrial flora and fauna interactions	
Description of risks	**Compliance with the following key management measures**
Terrestrial flora and fauna interaction could occur due to: • Potential fauna strikes due to vehicle inspections of pipeline corridor. • Erosion caused by access to onshore operational area or presence of the pipeline. • Potential for contribution to the spread of weed species, or interactions with protected flora species. • Potential fauna strike during drone use for pipeline inspections. • Potential fire may cause mortality or injury to fauna, vegetation and habitat damage.	• Protected Marine Fauna Interaction and Sighting Procedure. • Management of excavation activities. • Permit to work system. • Elimination of vehicle use for pipeline inspections and maintenance. • Incident Response Plan. • Change management procedure.

Table 3. Activity impacts and risk management ... continued

Unplanned subsurface release of hydrocarbon from the DCG Supply Pipeline	
Description of risks Sources of risk from a major hydrocarbon releases may occur as a result of: • Pipeline rupture caused by an integrity or corrosion issue, dropped object or anchor drag. • The maximum credible spill scenario as a result of a full pipeline rupture is the release of 121.4 m^3 of reindeer condensate over 3.75 hours.	**Compliance with the following key management measures** • Dropped object prevention procedures. • Navigational charting of infrastructure. • Inspection of hydrocarbon containing equipment. • Testing and maintenance of emergency shutdown systems and shutdown/ safety valves. • DEMIRS accepted safety case. • Inspection and corrosion monitoring. • Incident response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment. • Anchoring and equipment deployment management. • In the event of a hydrocarbon spill, an activity specific Oil Pollution Emergency Plan (OPEP) will be implemented to mitigate environmental impacts. The OPEP sets out environmental protection priorities and appropriate response measures for a range of spill scenarios. The OPEP is developed in accordance with National and State marine pollution plans.

Table 3. Activity impacts and risk management ... continued

Unplanned surface release of diesel from a vessel collision or bunkering	
Description of risks The maximum credible spill scenario as a result of a vessel collision is the release of 325 m^3 of marine diesel oil.	**Compliance with the following key management measures** • Navigational charting of infrastructure. • Navigation lighting and aids. • Seafarer Certification. • Refuelling and chemical transfer procedure. • Vessel spill response plan (SOPEP / SMPEP). • Support vessel positioning. • In the event of a hydrocarbon spill, an activity specific OPEP will be implemented to mitigate environmental impacts. The OPEP sets out environmental protection priorities and appropriate response measures for a range of spill scenarios. The OPEP is developed in accordance with National and State marine pollution plans.

Consultation

Consultation provides Santos with an opportunity to receive feedback from authorities, persons and organisations whose functions, interests or activities may be affected by proposed petroleum activities.

This feedback helps us to refine or change the management measures we plan to use to address any potential activity impacts and risks. Santos' objective for proposed activities is to reduce environmental impacts and risks to a level that is as low as reasonably practicable (ALARP) and acceptable over the life of the activity.

Consultation also helps us to identify values and sensitivities where information is not publicly available, such as spiritual and cultural connection to land and sea country, as well as to receive first-hand feedback on commercial and recreational fishing, tourism and local community activities and interests.

Providing feedback

You may be a relevant person if, for example, you have spiritual or cultural connections to land and sea country in accordance with Indigenous tradition that might be affected by our activity, or if you otherwise carry out recreational or commercial fishing, tourism or other activities that might be affected by our proposed activity, or if you are part of a local community that might be affected by our proposed activity.

If you consider that you may be a relevant person, please contact us by **28 June 2024** to allow Santos time to initiate consultation with you, so you can tell us how you would like to be consulted throughout the consultation process or if you need additional information. The consultation period for this EP closes on **29 July 2024**.

The merits of relevant person feedback provided through the consultation process will be considered during EP development, with a summary of responses summarised and included in the EP submitted to DEMIRS for assessment. Please let us know if you would like your personal/organisational details or any part of your feedback to remain private and we will ensure this remains confidential to DEMIRS.

More information about how community members can participate in environmental approvals for activities proposed in Commonwealth waters has been published in a **brochure** by DEMIRS.

Contact

E: offshore.consultation@santos.com
T: 1800 267 600
santos.com/offshoreconsultation

Information for commercial fishers

Santos

Review of Operations Environment Plans:

Reindeer Wellhead Platform and Offshore Gas Supply Pipeline
Devil Creek Gas Supply Pipeline and Sales Gas Pipeline

Information overview

Santos provides this supplementary information for commercial fishers as part of regulatory consultation activities for the five-year revisions of the Operations Environment Plans (EPs) for our Reindeer Wellhead Platform (WHP) and Devil Creek gas supply pipeline (DC supply pipeline) in Commonwealth waters and the State waters section of the DC supply pipeline in the Carnarvon Basin.

The revision of the EPs supports ongoing operations, as well as the preservation of facilities and pipelines, following the Cessation of Production (CoP), with the Reindeer field nearing the end of economic field life. Two EPs will be prepared, once each for Commonwealth and WA State jurisdiction.

Santos is seeking input from commercial fishers by **29 July 2024**. Details on consultation and providing input can be found on the back page of this fact sheet. Pre and post activity notifications are also available upon request.

General fact sheets on proposed activities in Commonwealth waters and WA State land and waters, including potential environmental impacts risks and associated management measures, can be found at **santos.com/offshoreconsultation**

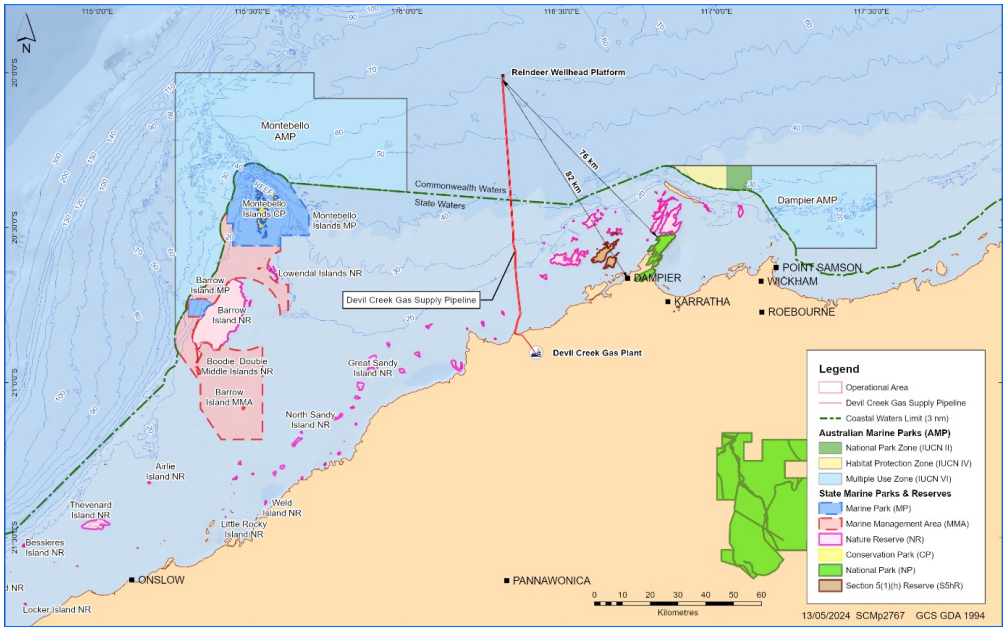

Figure 1. *Reindeer and Devil Creek Operations*

Activity details	
Proposed activity	• Production and transportation of hydrocarbons from the offshore Reindeer field to the onshore Devil Creek Gas Plant via DC supply pipeline) and then to the Dampier to Bunbury Natural Gas Pipeline, followed by suspension of operations. • Preservation of the Reindeer offshore facilities and offshore and onshore pipelines following the CoP.
Activity purpose	• Ongoing gas supply to WA domestic markets. • Preservation of facilities/pipelines ahead of a future decision by Santos on decommissioning or reuse of facilities/pipelines for potential Carbon Capture and Storage (CCS) at the depleted Reindeer field.
Operational Area location	• Reindeer WHP – 82 km north northwest of Dampier, Western Australia. • DC supply pipeline shore crossing – 42.6 km southwest of Dampier.
Water depth	61 m to shore
Timing and duration*	The duration of ongoing operations and the timing cessation of production will be dependent on Santos' decision-making for ongoing operations as well as decommissioning or re-purposing the DC supply pipeline for CCS.
Exclusion zone	There is a 500 m exclusion zone around the WHP, however there is no exclusion zone around the DC supply pipeline.

* Timing and duration of proposed activities are subject to change based on rig availability, adverse weather conditions or technical/equipment issues that may arise during operations.

Commercial fishery implications

Santos has undertaken an assessment to define the environmental, social, economic and cultural aspects that may be affected by proposed activities. To do this we have considered the totality of the area where activity impacts and risks may occur.

The widest extent of this area is called the Environment that May Be Affected (EMBA), which for this activity is a combined EMBA for the modelled potential worst-case hydrocarbon spill scenarios (rupture of the DC supply pipeline and vessel collision releasing marine diesel oil at the sea surface).

Table 1 provides an overview of those fisheries active in the Operational Area to determine potential for interaction with proposed activities. We have also assessed those fisheries that are entitled to fish in the EMBA. Operational Area coordinates can be found in **Table 2**.

Our fisheries assessment is based on publicly available government managed catch and effort data, our ongoing discussions with commercial fisheries representative organisations, and historic engagements for previous petroleum activities.

Table 1. Commercial fishery assessment

	Potential for interaction in Operational Area	Entitled to fish in the EMBA
Commonwealth Fishery		
North West Slope Trawl Fishery	No	Yes
Southern Bluefin Tuna Fishery	No	Yes
Western Deepwater Trawl Fishery	No	Yes
Western Skipjack Tuna Fishery	No	Yes
Western Tuna and Billfish Fishery	No	Yes
Western Australian Fishery		
Exmouth Gulf Prawn Limited Entry Fishery Creator	No	Yes
Mackerel Managed Fishery	Yes	Yes
Marine Aquarium Managed Fishery	Yes	Yes
Nickol Bay Prawn Limited Entry Fishery	No	Yes
Onslow Prawn limited Entry Managed Fishery	No	Yes
Pilbara Crab Managed Fishery	No	Yes
Pilbara Fish Trawl Managed Fishery	Yes	Yes
Pilbara Trap Managed Fishery	No	Yes
Shark and Demersal Gillnet and Demersal Longline Managed Fishery	No	Yes
Specimen Shell Managed Fishery	No	Yes
West Coast Deep Sea Crustacean Managed Fishery	No	Yes
West Coast Rock Lobster Managed Fishery	No	Yes
West Australian Sea Cucumber Fishery	No	Yes
Hermit Crab Fishery	No	Yes

Table 2. Operational Area coordinates

Operational Area	Latitude	Longitude
Reindeer WHP	20°01'26.738"S	116°18'34.999"E
DC supply pipeline shore crossing	20°49'29.891"S	116°21'07.517"E

Consultation

Consultation provides Santos with an opportunity to receive input from authorities, persons and organisations whose functions, interests or activities may be affected by the proposed activities.

This input helps us to refine or change the management measures we are planning to address potential activity impacts and risks.

Santos' objective for proposed activities is to reduce environmental impacts and risks to a level that is As Low As Reasonably Practicable (ALARP) and acceptable over the life of the activity.

Providing input

Santos is seeking input on proposed activities by **29 July 2024**.

The merits of relevant person feedback provided through the consultation process will be considered during EP development, with responses summarised and included in the EP submitted to NOPSEMA for assessment.

Please let us know if you would like your personal/organisational details or any part of your feedback to remain private and we will ensure this remains confidential to NOPSEMA.

More information about how community members can participate in environmental approvals for activities proposed in Commonwealth waters has been published in a **brochure** by NOPSEMA.

Contact

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T: 1800 267 600
santos.com/offshoreconsultation

Emails

From: Consultation, Santos
To: [redacted]
Subject: PRELIMINARY CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project
Date: Thursday, 30 May 2024 4:25:00 PM
Attachments: image001.png
image002.png
image003.png
image005.png

Preliminary Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**
- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)**

Santos is contacting you as we are proposing to undertake activities in Commonwealth and State waters offshore northern Western Australia, with respect to our existing Reindeer / Devil Creek Operations.

A revision of the in-force Environment Plans (EPs) is required for the respective Commonwealth and State waters operational components. Activity summaries are provided below for each component, and we have also embedded links in the images to respective fact sheets. These are published on our Consultation Hub at www.santos.com/offshoreconsultation.

The fact sheets include information on:

- the proposed activities;
- potential impacts, risks and management measures; and
- the presence, of environmental, social, economic and cultural features and/or values within the Environment That May Be Affected (EMBA) based on a review of publicly available information.

Reindeer / Devil Creek Operations Overview

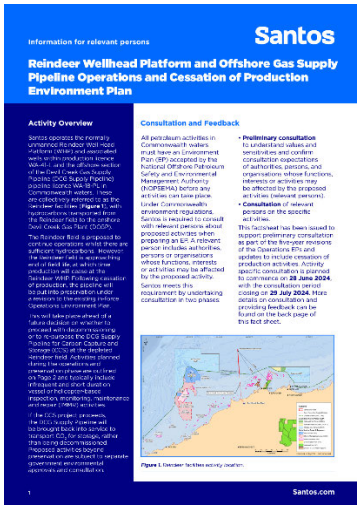
Santos operates the normally unmanned Reindeer Well Head Platform (WHP) and associated wells within production licence WA-41-L. The operational area of the Reindeer WHP is approximately 80 km north north-west of Dampier, Western Australia. An existing 103 km supply pipeline transports gas/condensate from the Reindeer WHP to the onshore Devil Creek Gas Plant, which is approximately 45 km southwest of Karratha. Reindeer gas is currently supplied into the Dampier to Bunbury Natural Gas pipeline for domestic use. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan**

  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the preservation of the Reindeer WHP and Gas Supply Pipeline following the Cessation of Production (CoP), with the Reindeer field approaching end of its commercially productive life. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

  At CoP Santos proposes to put the pipeline into preservation ahead of a future decision on whether to proceed with decommissioning of facilities or to re-purpose the supply

pipeline for Carbon Capture and Storage (CCS) at the depleted Reindeer field. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.


Information for relevant persons

Santos

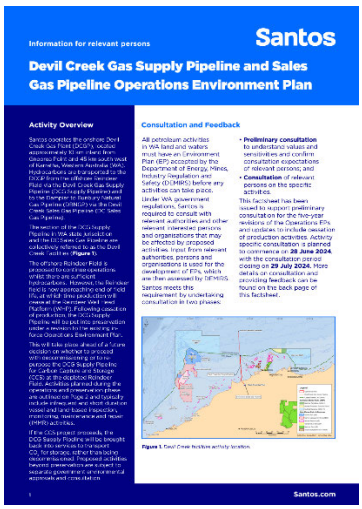
Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan

Activity Overview

Consultation and Feedback

Santos.com

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan**
  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the placement of the pipeline into preservation following COP from the Reindeer field.


Information for relevant persons

Santos

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan

Activity Overview

Consultation and Feedback

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Consultation Requirements

Under the Commonwealth government's environmental regulations, Santos is required to consult with relevant persons whose functions, interests and activities may be affected by proposed activities in Commonwealth waters. Input from relevant persons is used for the development of EPs, which are assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Under Western Australian government regulations, Santos is required to consult with relevant authorities and other relevant interested persons and organisations who may be affected by proposed activities in State waters. Input from relevant authorities, persons and organisations is used for the development of EPs, which are assessed by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).

Providing Input

Please contact us at the earliest opportunity if you consider you may be a relevant person and wish to participate in the consultation process. We can then discuss with you consultation methods appropriate to your information needs and interests, as well as arrange a suitable meeting date and location to discuss.

Consultation for these activities will commence on **28 June 2024**, with the consultation period closing on **29 July 2024.**

If you would like to provide input now, please note that a summary of your feedback will be included in the EP, including our assessment of your input and our response to you. You can provide input via return email or call us toll free on **1800 267 600**.

Please let us know if you would like any sensitive information to remain private. If requested, Santos will ensure your information remains confidential between us and NOPSEMA and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

Also, please let us know if you know of any other authorities, organisations or individuals who should participate in the consultation process.

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
Santos Consultation Team

From: Consultation, Santos
To: [redacted]
Subject: CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project
Date: Friday, 28 June 2024 1:34:19 PM
Attachments: image001.png
image002.png
image005.png

Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**
- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)**

Santos is contacting you again as we are now asking for any input to the revisions to our Environment Plans (EPs) with respect to our existing Reindeer / Devil Creek Operations.

The EPs are being revised for both the Commonwealth and State components of operations to support ongoing operations and the cessation of production from the Reindeer field, as it is approaching the end of its commercially productive life. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

For context and as described in our earlier correspondence, Santos operates the normally unmanned Reindeer Well Head Platform (WHP) and associated wells within production licence WA-41-L. The operational area of the Reindeer WHP is approximately 80 km north north-west of Dampier, Western Australia.

An existing 103 km supply pipeline transports gas from the Reindeer WHP to the onshore Devil Creek Gas Plant, which is approximately 45 km southwest of Karratha. Reindeer gas is currently supplied into the Dampier to Bunbury Natural Gas Pipeline for domestic use.

Providing input

Please contact us at the earliest opportunity so we can assess and respond to your input during the consultation period, which closes on **29 July 2024**.

Also, please let us know if you know of any other authorities, organisations or individuals who should participate in the consultation process.

More information on proposed activities can be found below in this email. You can provide input via return email or call us toll free on **1800 267 600**.

We look forward to hearing from you soon.

Regards

Santos Consultation Team

From: Consultation, Santos
Sent: 30 May 2024 16:27
To: [redacted]
Subject: PRELIMINARY CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project

Preliminary Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**
-

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)

Santos is contacting you as we are proposing to undertake activities in Commonwealth and State waters offshore northern Western Australia, with respect to our existing Reindeer / Devil Creek Operations.

A revision of the in-force Environment Plans (EPs) is required for the respective Commonwealth and State waters operational components. Activity summaries are provided below for each component, and we have also embedded links in the images to respective fact sheets. These are published on our Consultation Hub at www.santos.com/offshoreconsultation.

The fact sheets include information on:

- the proposed activities;
- potential impacts, risks and management measures; and
- the presence, of environmental, social, economic and cultural features and/or values within the Environment That May Be Affected (EMBA) based on a review of publicly available information.

Reindeer / Devil Creek Operations Overview

Santos operates the normally unmanned Reindeer Well Head Platform (WHP) and associated wells within production licence WA-41-L. The operational area of the Reindeer WHP is approximately 80 km north north-west of Dampier, Western Australia. An existing 103 km supply pipeline transports gas/condensate from the Reindeer WHP to the onshore Devil Creek Gas Plant, which is approximately 45 km southwest of Karratha. Reindeer gas is currently supplied into the Dampier to Bunbury Natural Gas pipeline for domestic use. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan**

  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the preservation of the Reindeer WHP and Gas Supply Pipeline following the Cessation of Production (CoP), with the Reindeer field approaching end of its commercially productive life. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

  At CoP Santos proposes to put the pipeline into preservation ahead of a future decision on whether to proceed with decommissioning of facilities or to re-purpose the supply pipeline for Carbon Capture and Storage (CCS) at the depleted Reindeer field. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.

Information for relevant persons

Santos

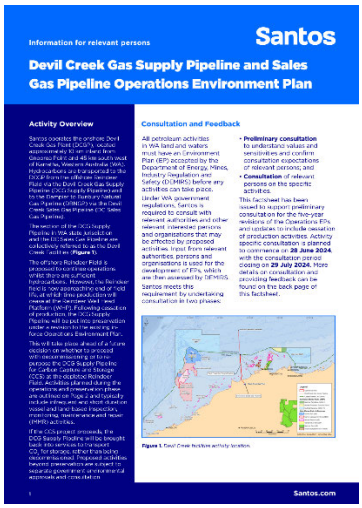
Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan

Activity Overview

Consultation and Feedback

Santos.com

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan**
  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the placement of the pipeline into preservation following COP from the Reindeer field.


Information for relevant persons

Santos

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan

Activity Overview

Consultation and Feedback

Santos.com

Consultation Requirements

Under the Commonwealth government's environmental regulations, Santos is required to consult with relevant persons whose functions, interests and activities may be affected by proposed activities in Commonwealth waters. Input from relevant persons is used for the development of EPs, which are assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Under Western Australian government regulations, Santos is required to consult with relevant authorities and other relevant interested persons and organisations who may be affected by proposed activities in State waters. Input from relevant authorities, persons and organisations is used for the development of EPs, which are assessed by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).

Providing Input

Please contact us at the earliest opportunity if you consider you may be a relevant person and

wish to participate in the consultation process. We can then discuss with you consultation methods appropriate to your information needs and interests, as well as arrange a suitable meeting date and location to discuss.

Consultation for these activities will commence on **28 June 2024**, with the consultation period closing on **29 July 2024.**

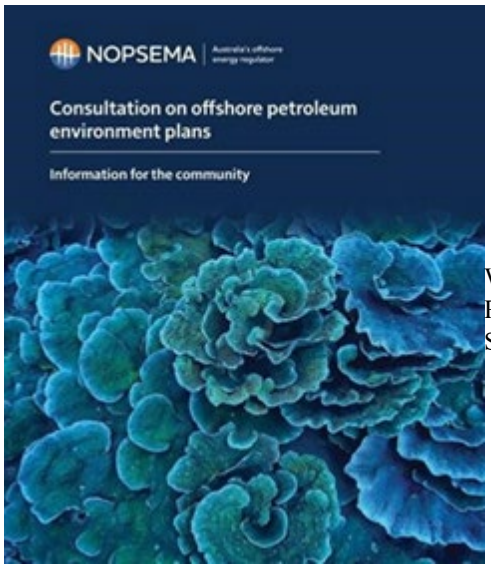
If you would like to provide input now, please note that a summary of your feedback will be included in the EP, including our assessment of your input and our response to you. You can provide input via return email or call us toll free on **1800 267 600**.

Please let us know if you would like any sensitive information to remain private. If requested, Santos will ensure your information remains confidential between us and NOPSEMA and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

Also, please let us know if you know of any other authorities, organisations or individuals who should participate in the consultation process.

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
Santos Consultation Team

From: Consultation, Santos
To: [redacted]
Subject: CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project
Date: Friday, 19 July 2024 9:40:40 AM
Attachments: image001.png
image002.png
image005.png

[redacted]

Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (Commonwealth waters)**
- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)**

Santos is contacting you by way of reminder to provide any input to the revisions of Environment Plans for our existing Reindeer / Devil Creek Operations.

Please get back to us at the earliest opportunity should you wish to provide input, noting that if we don't hear from you by **29 July 2024**, we will consider consultation with you closed for this EP, which will be submitted to respective Commonwealth and WA Regulators for assessment.

More information on proposed activities can be found below in this email. You can provide input via return email or call us toll free on **1800 267 600**.

We look forward to hearing from you soon.

Regards
Santos Consultation Team

From: Consultation, Santos <Offshore.consultation@santos.com>
Sent: 28 June 2024 13:29
To: [redacted]
Subject: CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project

Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**
- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)**

Santos is contacting you again as we are now asking for any input to the revisions to our Environment Plans (EPs) with respect to our existing Reindeer / Devil Creek Operations.

The EPs are being revised for both the Commonwealth and State components of operations to support ongoing operations and the cessation of production from the Reindeer field, as it is approaching the end of its commercially productive life. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

For context and as described in our earlier correspondence, Santos operates the normally

unmanned Reindeer Well Head Platform (WHP) and associated wells within production licence WA-41-L. The operational area of the Reindeer WHP is approximately 80 km north north-west of Dampier, Western Australia.

An existing 103 km supply pipeline transports gas from the Reindeer WHP to the onshore Devil Creek Gas Plant, which is approximately 45 km southwest of Karratha. Reindeer gas is currently supplied into the Dampier to Bunbury Natural Gas Pipeline for domestic use.

Providing input

Please contact us at the earliest opportunity so we can assess and respond to your input during the consultation period, which closes on **29 July 2024**.

Also, please let us know if you know of any other authorities, organisations or individuals who should participate in the consultation process.

More information on proposed activities can be found below in this email. You can provide input via return email or call us toll free on **1800 267 600**.

We look forward to hearing from you soon.

Regards

Santos Consultation Team

From: Consultation, Santos
Sent: 30 May 2024 16:25
To: [redacted]
Subject: PRELIMINARY CONSULTATION | Carnarvon Basin | Reindeer / Devil Creek Gas Project

Preliminary Consultation on:

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**
- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan (State waters)**

Santos is contacting you as we are proposing to undertake activities in Commonwealth and State waters offshore northern Western Australia, with respect to our existing Reindeer / Devil Creek Operations.

A revision of the in-force Environment Plans (EPs) is required for the respective Commonwealth and State waters operational components. Activity summaries are provided below for each component, and we have also embedded links in the images to respective fact sheets. These are published on our Consultation Hub at www.santos.com/offshoreconsultation.

The fact sheets include information on:

- the proposed activities;
- potential impacts, risks and management measures; and
- the presence, of environmental, social, economic and cultural features and/or values within the Environment That May Be Affected (EMBA) based on a review of publicly available information.

Reindeer / Devil Creek Operations Overview

Santos operates the normally unmanned Reindeer Well Head Platform (WHP) and associated wells within production licence WA-41-L. The operational area of the Reindeer WHP is approximately 80 km north north-west of Dampier, Western Australia. An existing 103 km supply pipeline transports gas/condensate from the Reindeer WHP to the onshore Devil Creek Gas Plant, which is approximately 45 km southwest of Karratha. Reindeer gas is currently supplied into the Dampier to Bunbury Natural Gas pipeline for domestic use. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan**

  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the preservation of the Reindeer WHP and Gas Supply Pipeline following the Cessation of Production (CoP), with the Reindeer field approaching end of its commercially productive life. The offshore Reindeer Field will continue production whilst there are sufficient hydrocarbons.

  At CoP Santos proposes to put the pipeline into preservation ahead of a future decision on whether to proceed with decommissioning of facilities or to re-purpose the supply pipeline for Carbon Capture and Storage (CCS) at the depleted Reindeer field. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.

Information for relevant persons

Santos

Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan

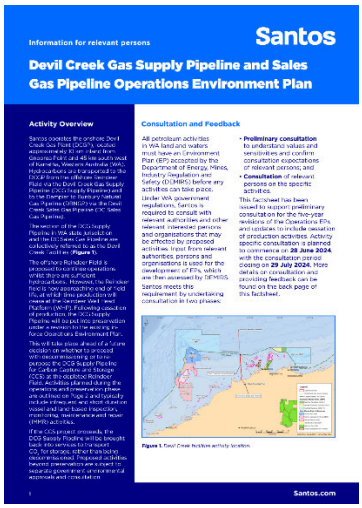
Activity Overview

Consultation and Feedback

Santos.com

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environmental Plan**

  A revision of the in-force EP is being undertaken to support ongoing operations, as well as the placement of the pipeline into preservation following COP from the Reindeer field.


Information for relevant persons

Santos

Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan

Activity Overview

Consultation and Feedback

Santos.com

Consultation Requirements

Under the Commonwealth government's environmental regulations, Santos is required to consult with relevant persons whose functions, interests and activities may be affected by proposed activities in Commonwealth waters. Input from relevant persons is used for the development of EPs, which are assessed by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Under Western Australian government regulations, Santos is required to consult with relevant authorities and other relevant interested persons and organisations who may be affected by proposed activities in State waters. Input from relevant authorities, persons and organisations is used for the development of EPs, which are assessed by the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS).

Providing Input

Please contact us at the earliest opportunity if you consider you may be a relevant person and wish to participate in the consultation process. We can then discuss with you consultation methods appropriate to your information needs and interests, as well as arrange a suitable meeting date and location to discuss.

Consultation for these activities will commence on **28 June 2024**, with the consultation period closing on **29 July 2024.**

If you would like to provide input now, please note that a summary of your feedback will be included in the EP, including our assessment of your input and our response to you. You can provide input via return email or call us toll free on **1800 267 600**.

Please let us know if you would like any sensitive information to remain private. If requested, Santos will ensure your information remains confidential between us and NOPSEMA and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our *Offshore Western Australia and Northern Territory Consultation Privacy Policy*.

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Additional resources

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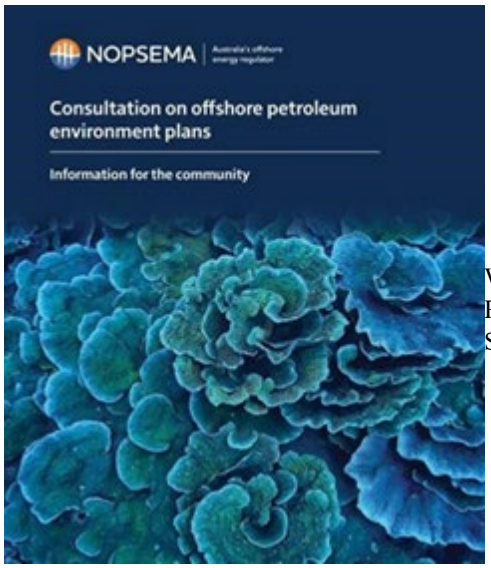


We look forward to hearing from you soon.
Regards
Santos Consultation Team

Advertising

SEEKING RELEVANT PERSONS

CARNARVON BASIN ENVIRONMENT PLANS

Santos

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed activities off Western Australia's north west coast.

Santos is planning proposed activities at our Western Australian interests:

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP).**
- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**

The Devil Creek Gas Supply Pipeline currently transports hydrocarbons from the Reindeer Well Head Platform (WHP) and associated wells within the Reindeer field to the Devil Creek Gas Plant. The Devil Creek Gas Plant (DCGP) pipeline is located approximately 10 km inland from Gnoorea Point and 45 km south west Karratha, and the Reindeer field is located offshore 103 km from DCGP.

The Reindeer Field is approaching end of its commercially productive life, at which time production will cease and Santos will need to commence planning for the progressive decommissioning. Santos proposes to continue operating the offshore Reindeer Field whilst there are sufficient hydrocarbons.

Following the Cessation of Production, the Devil Creek Gas Supply pipeline, Reindeer platform and wells will be put into a preserved state ahead of planned future use of the Devil Creek Gas Supply pipeline, Reindeer platform and wells for carbon capture and storage (CCS) with preservation currently estimated between 2024 and 2026, subject to matters such as field performance

The environment that may be affected (EMBA) by proposed activities

Santos is assessing impacts and risks to the environment that may be affected (EMBA) by this activity, 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 below depicts activity locations and a EMBA. The 'EMBA' represents the greatest spatial extent that could be affected by unplanned 'worst case' spill scenarios, noting that in the unlikely event of a spill not all environmental, social, economic and cultural aspects would be affected.

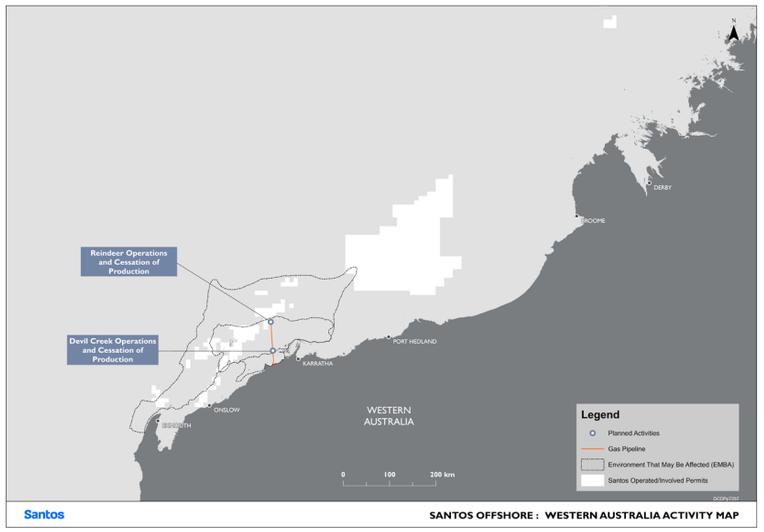
Santos is proposing to implement measures to reduce the impacts and risks of the activities. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable and to an acceptable level.

Seeking Relevant Persons for Environment Plans
All petroleum activities must have an Environment Plan (EP) accepted by the respective Commonwealth, State or Territory Regulator before they can take place.

Santos is required to consult with relevant persons about those activities when preparing each EP.

A relevant person includes a person or an organisation whose functions, interests or activities may be affected by the proposed activity. Such 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 activity (these are examples and not an exhaustive list).

Feedback from relevant persons is used to refine or change measures proposed to manage activity impacts and risks to a level that is as low as reasonably practicable and acceptable.



Consultation also helps us to identify environmental, social, economic and cultural values and sensitivities that may be affected, in addition to those identified by Santos based on our long-standing operating knowledge in these regions. If you think your functions, interests or activities may be affected by this activity, you may be a relevant person with whom Santos must consult.

We welcome your feedback

We will use feedback from relevant persons to help us manage impacts and risks associated with this activity, ahead of submitting our environment plan to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment. NOPSEMA acceptance of this environment plan is required before any petroleum activity can begin.

We have prepared consultation information sheets, which includes information about planned activities, identified environmental, social, economic and cultural aspects within each EMBA and how we propose to manage impacts and risks.

Contact us

If you consider you may be a relevant person, please contact us by **28 June 2024** to allow Santos to initiate consultation with you in relation to the proposed activity and so you can tell us how you would like to be consulted throughout this process.

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 activity on them.

Your feedback and input are important to us and input will be considered in the development of our environment plan.

Visit: **www.santos.com/offshoreconsultation/carnarvon**
Phone: **1800 267 600**
Email: **offshore.consultation@santos.com**
for more information, to self-identify as relevant person or to provide feedback.

CARNARVON BASIN ENVIRONMENT PLANS

Santos

Santos is now consulting with relevant persons whose functions, interests or activities may be affected by our proposed activities off Western Australia's north west coast.

Santos is planning proposed activities at our Western Australian interests:

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP).**
- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**

The Devil Creek Gas Supply Pipeline currently transports hydrocarbons from the Reindeer Well Head Platform (WHP) and associated wells within the Reindeer field to the Devil Creek Gas Plant (DCGP). The DCGP pipeline is located approximately 10 km inland from Gnoorea Point and 45 km south west Karratha, and the Reindeer field is located offshore 103 km from DCGP.

The Reindeer Field is approaching end of its commercially productive life, at which time production will cease and Santos will need to commence planning for the progressive decommissioning. Santos proposes to continue operating the offshore Reindeer Field whilst there are sufficient hydrocarbons.

Following Cessation of Production, Santos proposes to put the Devil Creek Gas Supply Pipeline, Reindeer platform and wells into preservation ahead of a future decision on whether to proceed with decommissioning of facilities or to re-purpose these facilities for Carbon Capture and Storage (CCS) at the depleted Reindeer field. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.

The environment that may be affected (EMBA) by proposed activities

Santos is assessing impacts and risks to the environment that may be affected (EMBA) by these 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 below depicts activity locations and a EMBA. The 'EMBA' represents the greatest spatial extent that could be affected by unplanned 'worst case' spill scenarios, noting that in the unlikely event of a spill not all environmental, social, economic and cultural aspects would be affected.

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Consultation

All petroleum activities must have an Environment Plan (EP) accepted by the respective Commonwealth, State or Territory Regulator before they can take place.

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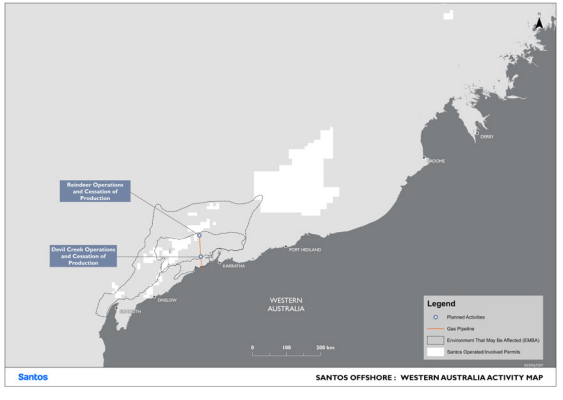

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We welcome your feedback

If you think your functions, interests or activities may be affected by these activities, you may be a relevant person with whom Santos must consult. We will use feedback from relevant persons to help us manage impacts and risks associated with these activities, ahead of submitting our environment plan to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment. NOPSEMA acceptance of this environment plan is required before any petroleum activity can begin.

We have prepared consultation information sheets, which includes information about planned activities, identified environmental, social, economic and cultural aspects within each EMBA and how we propose to manage impacts and risks.

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 **29 July 2024**.

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 activity on them.

Your feedback and input are important to us and input will be considered in the development of our environment plan.

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Phone: **1800 267 600**
Email: **offshore.consultation@santos.com**
for more information, to self-identify as relevant person or to provide feedback.

Santos

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed Reindeer / Devil Creek Gas continued operations activities off Western Australia's north west coast

Client: SANTOS
Campaign: Devil Creek Ops
Key Number: 5SAN030624A
Length: 30s
Date: 07.06.24
AM: Thea Petros
Writer: Supp/Amelia
Station/s: Hit 106.5 FM – Karratha
Contact: Thea Petros

VO **FEMALE; SERIOUS AND MATTER OF FACT.**

BED **SERIOUS AND PROFESSIONAL.**

PRON **KARRATHA – KUH- -RAA -THUH, LIKE ARTHER WITH CURR IN FRONT.**

VO Santos seeks to consult with persons whose functions, interests or activities may be affected by operation and preservation of our Reindeer offshore facilities approximately 82 kilometres northwest of Dampier, and the Devil Creek Gas Plant, approximately 45 kilometres southwest of Karratha.

To be consulted, please contact Santos by June 28.

See Santos dot com forward slash offshore consultation…

Call1800 267 600.

Or email offshore dot consultation at Santos dot com.

Please ensure all information in the script above is correct. Any changes after recording will incur an additional fee. ©2022 The Studio at SCA

THE STUDIO AT SCA

Campaign: Reindeer Ops
Key Number: 5SAN030624B
Length: 30s
Date: 07.06.24
AM: Thea Petros
Writer: Supp/Amelia
Station/s: Hit 106.5 FM – Karratha
Contact: Thea Petros

VO **FEMALE; SERIOUS AND MATTER OF FACT.**

BED **SERIOUS AND PROFESSIONAL.**

PRON **KARRATHA – KUH-RARTHER, LIKE ARTHER WITH CURR IN FRONT.**

VO Santos is consulting with persons whose functions, interests or activities may be affected by the operation and preservation of our Reindeer offshore facilities approximately 82 kilometres northwest of Dampier, and the Devil Creek Gas Plant, approximately 45 kilometres southwest of Karratha.

To be consulted, please contact Santos.

Consultation closes July 29.

See Santos dot com forward slash offshore consultation…

Call 1800 267 600.

Or email offshore dot consultation at Santos dot com.

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Tearsheets

Making dent in kids RSV

WA's infant immunisation program having a dramatic impact

CLAIRE SADLER

WA is reporting lower rates of RSV cases and hospital admissions than the rest of the country following the rollout of the State's infant immunisation program in April.

By the start of RSV Awareness Week (June 2-8), Australia had already recorded more than 47,000 cases of the virus in children aged under five, nearly two-thirds the total number of cases reported in 2023.

However, WA is reporting lower rates of respiratory syncytial virus cases with under five-year-olds in the State, having only 729 of the cases across the country.

Its smaller amount of cases comes as more than 10,000 infants have been immunised against RSV in the first two months of the program, which is expected to prevent at least 400 hospital admissions.

The virus usually causes mild, cold-like symptoms and people normally recover in a week or two. However it can be more serious, particularly for children under a year old who can develop pneumonia or bronchiolitis.

"Without immunisation, we know that around 12,000 Australian babies are hospitalised with pneumonia and bronchiolitis caused by RSV each year, with one-in four requiring intensive care," Immunisation Foundation of Australia director Catherine Hughes said.

"Hospitalisation data from Western Australia shows a low rate of infant admission due to RSV for this time of the year. The message is clear — infant RSV immunisation keeps babies out of hospital."

Despite the lower rates of RSV in young children, Perth epidemiologist Associate Professor Hannah Moore urged parents to get their babies immunised as a winter spike was expected.

"With the recent cool change in weather, we're expected to see a spike in reported cases of the seasonal virus in the west," she said. A mother of twins, Nicola Woolf, said immunisation would have meant there was a much lower chance of her children being admitted to hospital with severe RSV.

"The doctor examined my son and said you just need to go right now to emergency as he is not breathing properly and is working extremely hard to breathe," Ms Woolf said.

"I ended up taking both kids in with me to the hospital. My daughter was happy and eating well but they examined her anyway and it was actually her that they were most worried about in the end with her breathing, which was really scary.

"They both were admitted and both put on all different forms of oxygen because their oxygen just kept dropping.

"It was after admission when we were sent home to manage on our own that was the most stressful."

Ms Woolf urged other parents to opt for their immunisation ahead of the winter surge.

"RSV just seems like something the twins are going to be susceptible to when they go into day care every winter season so I'm definitely encouraging all parents out there to take up the option for immunisation," Ms Woolf said.

Nicole Woolf's 18-month-old twins Raphael and Abigail were admitted to hospital last year. Picture: Ross Swanborough

SEEKING RELEVANT PERSONS

Santos

CARNARVON BASIN ENVIRONMENT PLANS

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed activities off Western Australia's north west coast.

Santos is planning proposed activities at our Western Australian interests:

- **Dorit Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP).**
- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**

The Dorit Creek Gas Supply Pipeline currently transports hydrocarbons from the Reindeer Well Head Platform (WHP) and associated wells within the Reindeer field to the Dorit Creek Gas Plant. The Dorit Creek Gas Plant (DCGP) pipeline is located approximately 30 km inland from Groovina Point and 65 km south west Karratha, and the Reindeer field is located offshore 103 km from DCGP.

The Reindeer Field is approaching end of its commercially productive life, at which time production will cease and Santos will need to commence planning for the progressive decommissioning. Santos proposes to continue operating the offshore Reindeer Field whilst there are sufficient hydrocarbons.

Following the Cessation of Production, the Dorit Creek Gas Supply pipeline, Reindeer platform and wells will be put into a preserved state ahead of planned future use of the Dorit Creek Gas Supply pipeline, Reindeer platform and wells for carbon capture and storage (CCS) with preservation currently estimated between 2024 and 2026, subject to matters such as field performance.

The environment that may be affected (EMBA) by proposed activities

Santos is assessing impacts and risks to the environment that may be affected (EMBA) by this activity, 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 below depicts activity locations and a EMBA. The 'EMBA' represents the greatest spatial extent that could be affected by unplanned "worst case" spill scenarios, noting that in the unlikely event of a spill not all environmental, social, economic and cultural aspects would be affected.

Santos is proposing to implement measures to reduce the impacts and risks of the activities. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable and to an acceptable level.

Seeking Relevant Persons for Environment Plans

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Feedback from relevant persons is used to refine or change measures proposed to manage activity impacts and risks to a level that is as low as reasonably practicable and acceptable.

Consultation also helps us to identify environmental, social, economic and cultural values and sensitivities that may be affected. In addition to those identified by Santos based on our long-standing operating knowledge in these regions. If you think your functions, interests or activities may be affected by this activity, you may be a relevant person with whom Santos must consult.

We welcome your feedback

We will use feedback from relevant persons to help us manage impacts and risks associated with this activity, ahead of submitting our environment plan to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment. NOPSEMA acceptance of the environment plan is required before any petroleum activity can begin.

We have prepared consultation information sheets, which includes information about planned activities, identified environmental, social, economic and cultural aspects within each EMBA and how we propose to manage impacts and risks.

Contact us

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for more information, to self-identify as relevant person or to provide feedback.

Team celebrates one year

JESSICA MORONEY

Workpower Geraldton is celebrating one year since taking over former disability support agency Activ Foundation and ensuring people with disability have secure employment.

On Friday, the team at Workpower Geraldton celebrated the organisation's one-year anniversary with a barbecue lunch.

City of Greater Geraldton mayor Jerry Clune attended and received a tour of the workshop.

Workpower took over operations on June 12 last year after Activ Foundation announced the closure of seven workshops across the State.

It left about 750 people with disabilities fearing for their employment future.

Workpower chief executive Lee Broomhall said the acquisition has ensured people in Geraldton can continue with the work they are proud of.

"We're very proud of the progress we've made over the past year," she said.

"We've successfully transitioned seven worksites across Western Australia and integrated well into the local communities, creating valuable partnerships with local businesses, and providing opportunities for people with disability to thrive in a supportive and inclusive environment."

Workpower is the Mid West's largest craypot manufacturer and was awarded for their leadership and development programs at the Western Australian Fishing Industry Council Inc's annual awards earlier this year.

The company was recognised for employing more than 21 people with disability to manufacture high-quality pots, with some team members having more than 20 years experience in shaping pots.

ABOVE: Employees Darcy Owen, Jon Sindelar, Ryan Mitchell, Jon Taylor, and Jordan Cole. RIGHT: Geraldton mayor Jerry Clune visits.

Boost for DV victim support

JESSICA MORONEY

Two Mid West organisations have received a share of $7 million to provide individual support for people experiencing family, domestic and sexual violence.

Last week the State Government announced funding would be allocated over two years to continue the Flexible Support Package program, providing individualised support packages to victim-survivors. More than 40 family and domestic violence organisations across the State will receive a share of the funding.

In Geraldton, Desert Blue Connect and Mission Australia will share a portion of the funding, which will be used as direct financial support in the Mid West.

People can access practical supports to improve safety and rebuild their lives, such as furniture and household goods or items to meet daily living needs.

Prevention of Family and Domestic Violence Minister Sabine Winton said no two experiences of family and domestic violence were the same and individualised support could help people in areas that were most needed.

SEEKING RELEVANT PERSONS

CARNARVON BASIN ENVIRONMENT PLANS

Santos

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed activities off Western Australia's north west coast.

Santos is planning proposed activities at our Western Australian interests:

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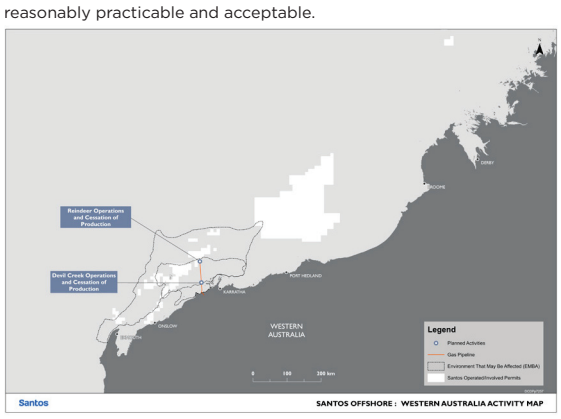

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Email to gun owners defended

JAKE DIETSCH & DYLAN CAPORN

WA Police are imposing gun limits that have not been legislated — warning new firearm applicants that their forms will be rejected under reforms being debated in Parliament.

Police modelling has shown up to 85,000 licensed firearms are set to be impacted by the new laws.

Emails from WA Police to applicants for firearms — obtained by The West — reveal that officers have cited the Firearms Bill 2024, which has passed the Legislative Assembly but not the Legislative Council, and told applicants that they would be refused because of the proposed laws.

They are then told to change their application by either disposing of "one of your currently licensed firearms" to a police station under a voluntary buyback scheme or getting a different licence.

"If you request that your application is put through with no changes to your licence, it will lead to the approval sergeant refusing your application," the email says.

"If this occurs, you will have the option to lodge a dispute with the State Administrative Tribunal."

The correspondence comes despite the Government seeking to amend the law to make it easier to seize guns from suspected domestic violence offenders.

It follows the murder-suicide in Floreat where gunman Mark Bombara killed Jennifer and Gretl Petelczyc in search for his ex-partner before turning the weapon on himself.

Police Minister Paul Papalia. Picture: Riley Churchman

Opposition Leader Shane Love, whose National Party is against the Bill, said police were being "presumptive".

"The legislation hasn't passed through the Parliament. We now know that the Government itself is again making amendments to the legislation," Mr Love said.

The Nationals leader said regulations that underpin the legislation were yet to be written and Police Minister Paul Papalia had promised consultation with shooting groups as they were developed.

"So how you could possibly be sending letters out before either the legislation or the regulations have been delivered is beyond me," Mr Love said.

Mr Papalia confirmed in Parliament this week that WA Police had endorsed a change to their firearms licensing process procedures, adopting a policy position to better align with the Bill. "It's absolutely appropriate that every licensed firearms owner in the State be notified of the opportunity to participate in the buyback scheme.," he said.

"For people specifically who currently exceed the proposed limits, it's fair that they'd be notified so they can participate in the buyback scheme.

"Otherwise at the end when of the process when the law comes into effect, if they are in excess of their numbers of firearms that they hold or in excess of the allowable limit — all of the firearms will be seized."

The State Government has bought back more than 13,000 firearms, with modelling showing up to 85,000 firearms were set to be impacted by the legislation.

Mr Papalia warned that firearm owners who breached the new laws would have of their weapons taken away.

"The changes will remove tens of thousands of firearms from the community, making our streets safer for everyone," he said.

"If gun owners don't comply with the strict new requirements when the new laws come into effect, their licence will be revoked and they could face criminal charges.

"The Cook Government's $64.3 million dollar buyback offers firearm owners an opportunity to get paid for their guns."

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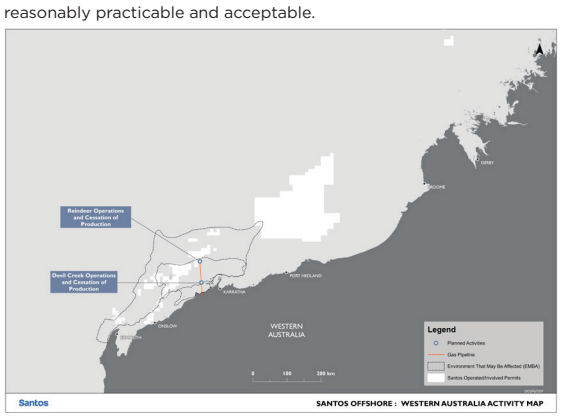

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Dutton forges ahead of Albo

ADELAIDE LANG

Opposition Leader Peter Dutton has edged out Prime Minister Anthony Albanese as the preferred leader as recent polling shows support for Labor is decreasing on critical issues.

It's the first time Mr Dutton has eclipsed Mr Albanese as the preferred prime minister in the Resolve Political Monitor, the surveys regularly conducted for the Sydney Morning Herald.

The findings published by the masthead show the Opposition Leader has gained a narrow lead over his opponent with 36 per cent of voter support compared to 35 per cent for Mr Albanese.

When asked how the Prime Minister was performing in office, 36 per cent of respondents said he was doing a good job while 50 per cent of respondents said he was doing a poor job.

Meanwhile, Mr Dutton attracted praise from 42 per cent of voters while 40 per cent rated his performance as poor.

The surveys showed support for the Coalition remained steady at 36 per cent over the past month, but Labor's primary vote fell to a three-year low of 28 per cent. Notably, 40 per cent of voters canvassed for the poll ranked Mr Dutton and the Coalition the top choice to manage the economy while 24 per cent chose Mr Albanese and Labor.

Peter Dutton Pic: NewsWire

On the topic of national security and defence, 42 per cent backed the Opposition Leader while 23 per cent supported the Prime Minister.

When asked which leader would do a better job of keeping the cost of living low, 32 per cent of voters backed Mr Dutton while 25 per cent favoured Mr Albanese. The results reflect the country's growing frustration with soaring prices and the impact of consistent interest rate hikes.

When voters were asked to identify the most important policy issue, 54 per cent pointed to keeping the cost of living low.

Mr Dutton was favoured by 32 per cent of respondents as the safer hands for the job, while Mr Albanese held the support of 25 per cent.

However, both major parties held equal standing with backing from 32 per cent of the voters on the issue of jobs and wages.

Mr Albanese and Labor attracted more support on the issue of environment and climate, with 24 per cent of the vote in contrast to 22 per cent support for Mr Dutton and the Coalition.

The findings come after Mr Dutton refused to reveal key details of the Coalition's nuclear power policy after declaring he would oppose a 2030 carbon emissions target at the next election.

The polling also revealed good news for the Greens, who gained two percentage points of support and lifted their primary vote from 12 to 14 per cent.

City of Karratha

TEMPORARY ROAD CLOSURE
HILLVIEW ROAD

In accordance with section 3.50(1)a of the *Local Government Act 1995*, notice is hereby given that the Contractor, BCP Contractors Pty Ltd, proposes to partially close Hillview Road to the east and west of Balmoral Road temporarily, for a period of approximately ten weeks (15 July to 23 September 2024) weather dependent to facilitate the Hillview and Balmoral Roads Reconstruction.

Active work hours will be between 7am - 7pm, Monday to Saturday operating under road closures.

Local users, together with pedestrian and cyclist movements will be retained during the closure period.

The community are requested to exercise caution and obey all warning signs and directions from the authorised contractor.

The City appreciate your support and patience as we continue to improve our road network and amenities while these works are ongoing.

Further details about this closure are available on the City's website, https://karratha.wa.gov.au/council/projects-and-works/hillviewbalmoral-road-reconstruction.

Any person wishing to comment on the closure may lodge a written submission by Wednesday, 4 July 2024. Submissions should be forwarded to the City of Karratha, PO Box 219, Karratha WA 6714 or email to enquiries@karratha.wa.gov.au.

For further information, contact BCP Contractors Pty Ltd on (08) 9752 1000 or 0439 957 576.

Virginia Miltrup
Chief Executive Officer

4894327

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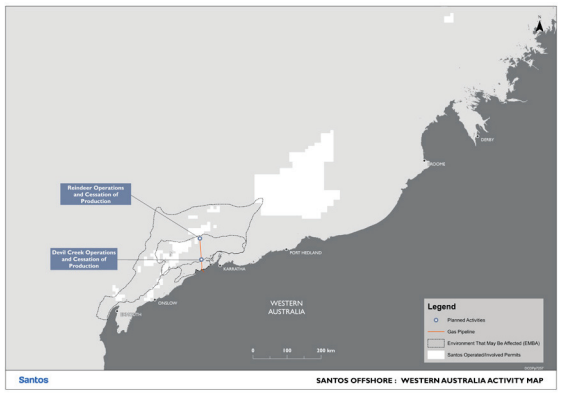

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Cycling champion Ava Rodgers whose mother is worried about rising insurance premiums. Opposite page: RBA governor Michele Bullock. Main picture: Jackson Flindell

Cars, houses feel the heat

SEAN SMITH

West Australian households are labouring under another year of soaring insurance premiums as insurers ramp bills up even higher to cover escalating repair costs for homes and cars.

The State's biggest general insurer, the RAC, has revealed that while annual premium increases have moderated over the past year, they are still running ahead of the annual inflation rate of 4 per cent, with renewing customers being hit with price rises of up to 19 per cent.

RAC, which finished the 2023 financial year with about 56 per cent and 35 per cent of the State's motor and home and contents markets respectively, sees little immediate relief for households, warning "we are unlikely to see a deflation in claims".

This time last year, the motoring mutual was slapping customers with premium rises of 15 per cent to 20 per cent, insisting they were necessary to meet the high cost of car parts, labour and building repairs.

"For current renewals, premium increases typically range between 4 and 19 per cent," the RAC told The West Australian. "The rate of change is slowing, but the underlying cost base is still going up. This includes supply-chain inflation which has driven up the cost of claims. The cost and availability of materials, parts, trades and services continues to be an issue for home and car repairs in WA. An example of this is additional features in newer cars are costly to repair and calibrate."

This is particularly true for electric vehicles, with a recent British study quoted by investment bank Macquarie finding EV claims were 25.5 per cent more expensive than internal combustion engine equivalents and took 14 per cent longer to repair.

Data from the Insurance Council of Australia shows the nation's home-building insurance premiums rose an average 13.9 per cent in the year to March 31, followed by a 12.7 per cent rise in motor insurance and 3.7 per cent rise for household contents premiums.

Insurance Australia Group, which operates some of the country's biggest general insurance brands including NRMA and CGU, did not reveal its current premium rises.

However, it acknowledged the growing cost-pressure on households, adding it was "working to keep increases to a minimum for our customers".

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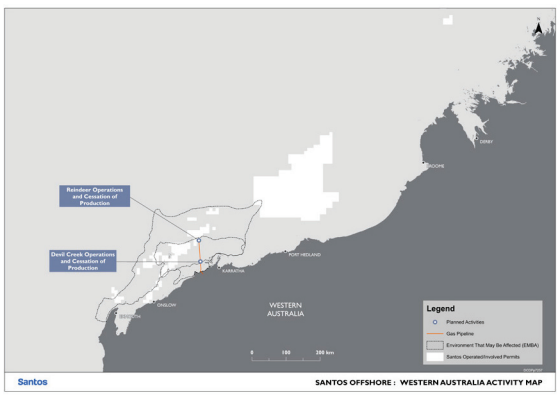

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Dignity the winner amid 'theft' furore

ANNA COX

A Geraldton woman who was set to go to trial for stealing sanitary products worth $10 could soon have her charge dropped after news of the case sparked outrage in the community.

The story prompted period equity organisation Share the Dignity to call for systemic changes to improve access to these essential products to help tackle the growing problem of period poverty.

The 31-year-old woman was alleged to have stolen $10 worth of sanitary products from a store in Bluff Point on January 9.

She was listed to appear in Geraldton Magistrates Court on June 10, but could not appear after contracting COVID and her matter is listed to go to trial on July 29.

The story was picked up by Share the Dignity, and attracted thousands of comments on its social media pages expressing outrage the matter had progressed this far and the costs of going to trial.

Mid West Supt Steve Post confirmed to the Geraldton Guardian that the charges were in the process of being dropped by the complainant. "It's in the process of being discontinued," he said.

Share the Dignity founder and chief executive Rochelle Courtenay said: "The fact that stealing them is your only option is a really sad reflection of society."

A change is in the air

DYLAN CAPORN

West Australians will now be warned of natural disasters — such as fires, floods and cyclones — via a consistent three-level alert system under changes revealed by the State Government on Monday.

Under the Australian Warning System, which is being rolled out across WA, all hazards will share the same language, colour and icons across Australia.

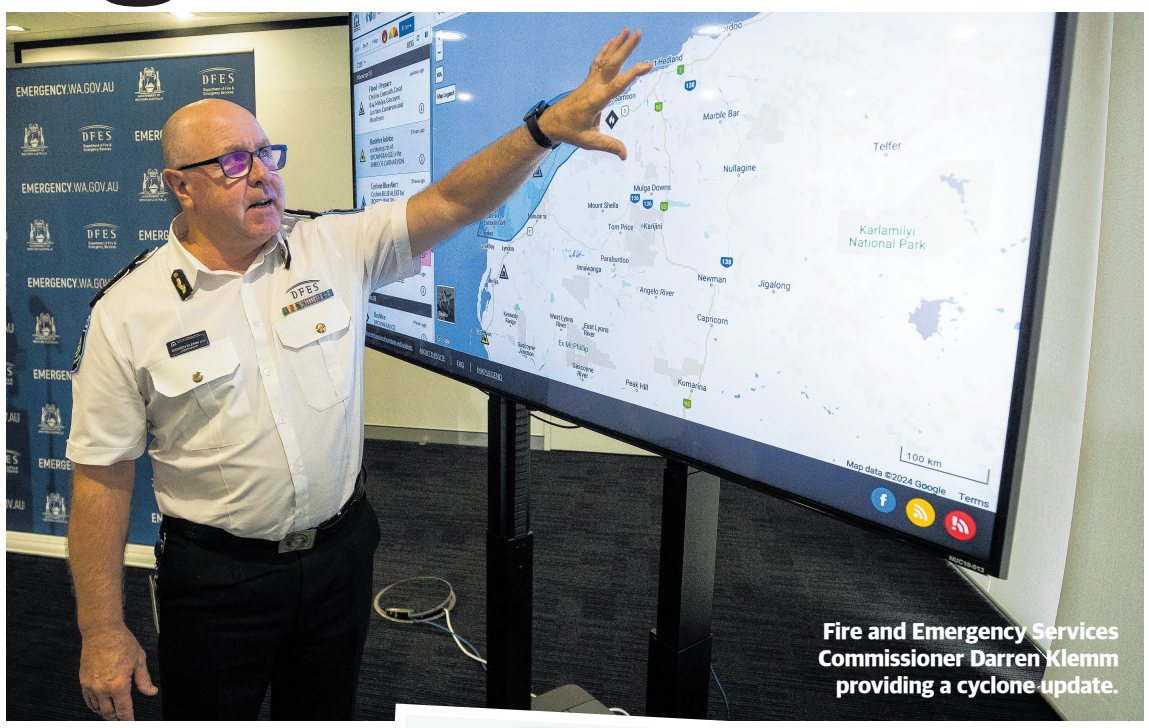
The new system will replace the current warning for cyclones — blue, yellow and red alerts — with the same model currently used for bushfires. The three levels of alerts across all disasters will be simplified to advice, watch and act, and emergency warning on the State's Emergency WA platform and website.

Advice will prompt nearby residents to be aware of an incident, providing no immediate threat to lives or homes.

Watch and act will ask locals to protect themselves due to a "possible threat", while the emergency warning will alert residents to danger from a threat to lives and homes.

The new model will also remove the 'all clear' level, which will be replaced by a final advice message highlighting the remaining hazards after a cyclone has passed or a bushfire is extinguished.

Emergency Services Minister Stephen Dawson also announced a $16 million upgrade to the Emergency WA website.



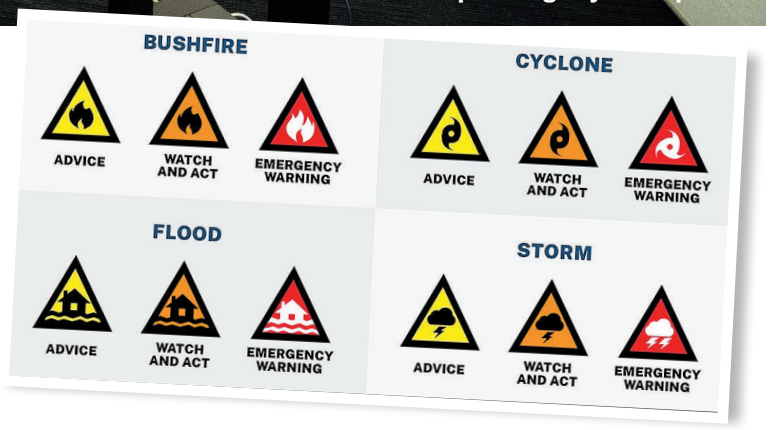
Fire and Emergency Services Commissioner Darren Klemm providing a cyclone update.

WARNING SYSTEM

Advice: An incident has started but there is no immediate threat. Be aware and keep up to date.

Watch and Act: There is a possible threat to lives and homes. Take action now to protect yourself and others.

Emergency Warning: There is a threat to lives and homes. You may be in danger and need to take immediate action.



New warning icons for emergencies in WA.

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Following Cessation of Production, Santos proposes to put the Devil Creek Gas Supply Pipeline, Reindeer platform and wells into preservation ahead of a future decision on whether to proceed with decommissioning of facilities or to re-purpose these facilities for Carbon Capture and Storage (CCS) at the depleted Reindeer field. Proposed activities beyond preservation are subject to separate government environmental approvals and consultation.

The environment that may be affected (EMBA) by proposed activities

Santos is assessing impacts and risks to the environment that may be affected (EMBA) by these 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 below depicts activity locations and a EMBA. The 'EMBA' represents the greatest spatial extent that could be affected by unplanned 'worst case' spill scenarios, noting that in the unlikely event of a spill not all environmental, social, economic and cultural aspects would be affected.

Santos is proposing to implement measures to reduce the impacts and risks of the activities. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable and to an acceptable level.

Consultation

All petroleum activities must have an Environment Plan (EP) accepted by the respective Commonwealth, State or Territory Regulator before they can take place.

Santos is required to consult with relevant persons about those activities when preparing each EP.

A relevant person includes a person or an organisation whose functions, interests or activities may be affected by the proposed activities. Such 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 activity (these are examples and not an exhaustive list).

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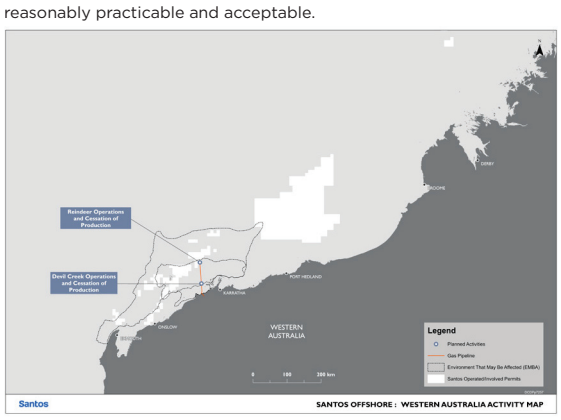

Consultation also helps us to identify environmental, social, economic and cultural values and sensitivities that may be affected, in addition to those identified by Santos based on our long-standing operating knowledge in these regions.

We welcome your feedback

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We have prepared consultation information sheets, which includes information about planned activities, identified environmental, social, economic and cultural aspects within each EMBA and how we propose to manage impacts and risks.

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Your feedback and input are important to us and input will be considered in the development of our environment plan.

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Email: **offshore.consultation@santos.com**
for more information, to self-identify as relevant person or to provide feedback.

ASIC commissioner Alan Kirkland.
Picture: LinkedIn

Customers to get fee refund

CHEYANNE ENCISO

> We're expecting all of them to read the report and make improvements to their practices.
> **Alan Kirkland**

Four Australian banks will cough up nearly $30 million in refunds after a review by the Federal corporate watchdog revealed they had charged high fees to customers who could least afford it.

A report from the Australian Securities and Investments Commission revealed ANZ, Commonwealth Bank, Westpac, as well as mid-tier Bendigo and Adelaide Bank kept at least two million low-income customers in high-fee accounts.

These included many customers relying on Centrelink payments.

The report released on Monday came after an ASIC review focused on improving financial outcomes for First Nations customers by addressing avoidable bank fees.

"We focused in this project on the banks who were most likely to have First Nations consumers on low incomes trapped in high-fee accounts," ASIC Commissioner Alan Kirkland said. ASIC said the four banks have committed to moving more than 200,000 customers into low-fee accounts, saving them about $10.7m a year.

The financial institutions will also refund more than $28m in fees to these customers over the next 12 to 18 months.

This includes $24.6m to Aboriginal and Torres Strait Islander students and apprentices receiving ABSTUDY payments, and customers in areas with significant First Nations populations.

"At any time ASIC, and the community, expects that the banks will treat their customers fairly," Mr Kirkland, pictured, said.

"But that's particularly important for people on low incomes and for people who are struggling to make ends meet, the last thing they need is to have the very little income that they have being eaten away in unnecessary bank fees."

Before the review, Mr Kirkland said most banks only provided their customers with difficult opt-in processes for switching to low-fee options, including forcing some to travel hundreds of kilometres to their nearest bank branch.

He said the implications of ASIC's latest review applied to all banks across the country.

"We're expecting all of them to read the report and make improvements to their practices to stop other people being trapped in high-fee accounts that they can't afford," Mr Kirkland said.

ASIC in the report provided recommendations to minimise harm to customers, including improving processes for customers opening accounts, and to migrate from high-fee to low-fee accounts.

CARNARVON BASIN ENVIRONMENT PLANS

Santos

Santos is now consulting with relevant persons whose functions, interests or activities may be affected by our proposed activities off Western Australia's north west coast.

Santos is planning proposed activities at our Western Australian interests:

- **Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP).**
- **Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations and Cessation of Production Environment Plan (EP).**

The Devil Creek Gas Supply Pipeline currently transports hydrocarbons from the Reindeer Well Head Platform (WHP) and associated wells within the Reindeer field to the Devil Creek Gas Plant (DCGP). The DCGP pipeline is located approximately 10 km inland from Gnoorea Point and 45 km south west Karratha, and the Reindeer field is located offshore 103 km from DCGP.

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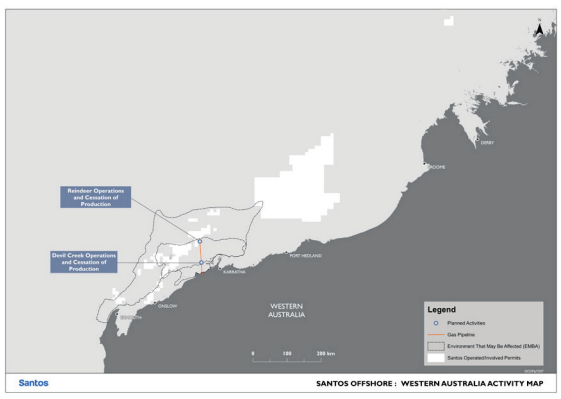

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for more information, to self-identify as relevant person or to provide feedback.

Appendix G Environmental consequence levels used for impact assessment

Offshore Division Environmental Hazard Identification and Assessment Guideline - Environmental Consequence Descriptors

Consequence Level		I	II	III	IV	V	VI
Acceptability		**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; Wide spread (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[3]; habitat within a protected area; habitats that include benthic primary producers[4] and/ or epi-fauna[5]	No or negligible reduction in physical environment / habitat area/function.	Detectable but localised and insignificant loss of area/function of physical environment / habitat. Rapid recovery evident within ~ 2 year (two season recovery)	Significant loss of area and/or function of local physical environment / habitat. Recovery over medium term (2–10 years)	Major, large-scale loss of area and/or function of physical environment / local habitat. Slow recovery over decades.	Extensive destruction of local physical environment / habitat with no recovery; Long term (decades) and wide spread loss of area or function of primary producers on a regional scale.	Complete destruction of regional physical environment / habitat with no recovery. Complete loss of area or function of primary producers on a regional scale.
	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	No or negligible loss of value of the local industry;	Detectable but insignificant short-term loss of value of the local industry. Detectable but insignificant reduction in key	Significant loss of value of the local industry; Significant medium term reduction of key natural features or	Major long-term loss of value of the local industry and threat to viability.	Shutdown of local industry or widespread major damage to regional industry;	Permanent shutdown of local or regional industry;

Consequence Level		I	II	III	IV	V	VI
Acceptability		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.*
	and gas; defence; commercial shipping.	No or negligible reduction in key natural features or populations supporting the activity.	natural features or population supporting the local activity.	populations supporting the local activity.	Major reduction of key natural features or populations supporting the local activity.	Extensive loss of key natural features or populations supporting the local industry.	Permanent loss of key natural features or populations supporting the local or regional industry.

3 As defined by the Department of Agriculture, Water and Environment (DaWE)

4 Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves

5 Fauna attached to the substrate including sponges, soft corals and crinoids.

Appendix H OPEP

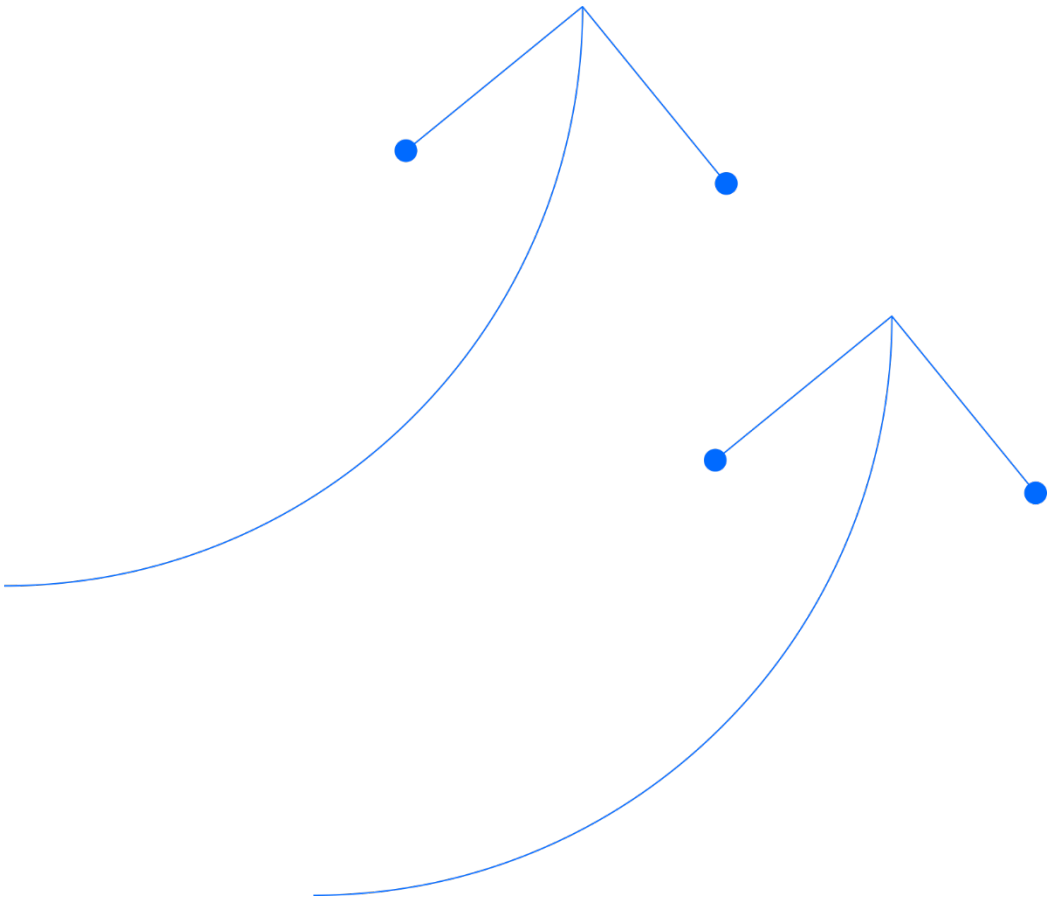
Santos

Devil Creek Pipeline and Reindeer Well Head Platform

Oil Pollution Emergency Plan

8 April 2025

Document No.: EA-14-RI-10001.02



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Devil Creek Pipeline and Reindeer Well Head Platform

Oil Pollution Emergency Plan

Document No.: EA-14-RI-10001.02

Project / Facility	Devil Creek & Reindeer WHP
Review interval (months)	30 Months
Safety critical document	NO

Rev	Owner	Reviewer/s *Managerial/ Technical/ Site*	Approver
	Lead Oil Spill Risk & Planning Coordinator	**Oil Spill Risk & Planning Advisor** **Principal Oil Spill and Emergency Response Coordinator**	**Manager Environment (WA, NA & TL)**
15		 p.p.	

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Rev	Rev Date	Author / Editor	Amendment
15	08/04/2025	Santos	Revised following NOPSEMA RFFWI2 comments (including some minor admin. updates).
14	09/09/2024	Santos	Updated to include both operations and CoP phases.
13.1	09/05/2024	Santos	Updated to incorporate changes in ERT structure and communications as outlined in MoC 301.
13	18/05/2023	Santos	Response to DMIRS comments received on 05.05.23.
12	13/04/2023	Santos	Response to DMIRS comments received 03.03.23. Response to DoT comments received 16.03.23.
11	10/01/2023	Santos	2.5 year regulatory revision to DMIRS
10.1	31/01/2022	Santos	Updated to incorporate changes in IMT structure, roles and responsibilities and exercise requirement as outlined in MoC 241.
10	29/07/20	Santos	Revised following DMIRS comments Minor updates for revised DoT Industry Guidance Note, AMOSC oiled wildlife State-board and information on DISER
9	22/05/20	Santos	Revised following DMIRS comments
8	03/04/20	Santos	Revised following NOPSEMA opportunity to modify and resubmit
7	17/12/19	Santos	Revised following NOPSEMA request for further written information
6	10/05/19	Advisian	5-year revision to NOPSEMA
5	04/05/17	N/A	Revised following DMP and DoT comments
4	13/02/17	N/A	2.5 year regulatory revision to DMP
3	05/08/14	N/A	Revised following NOPSEMA acceptance of Rev 2 when taken with the 'request for further written information' (RFFWI)) – This revision includes the RFFWI content for submission to DMP (05/08/14)
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0	29/08/13	N/A	Issued for use
A	27/08/13	N/A	Internal review

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WA DoT	●
AMSA	●
AMOSC	●
OSRL	●
DEMIRS	●
Intranet – Emergency Preparedness – both Oil Spill tile and SO ER Documentation	●

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Terms

Term	Definition
AEP	Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association [APPEA]; from 13 September 2023)
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
BAOAC	Bonn Agreement Oil Appearance Codes
BIP	Bridging Implementation Plan
CCR	Central Control Room
CMT	Crisis Management Team
CSB	Commonwealth State Boundary
DBCA	Department of Biodiversity, Conservation and Attractions
DBNGP	Dampier to Bunbury Natural Gas pipeline
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCGP	Devil Creek Gas Plant
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DISR	Department of Industry, Science and Resources
DoT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EMBA	Environment That May Be Affected
EP	Environment Plan
ER	Emergency Response
ERT	Emergency Response Team
ESD	Emergency Shutdown
EVA	Environmental Value Areas
FOB	Forward Operating Base
GAPA	Government and Public Affairs
GIS	Geographic Information System
GPS	Global Positioning System
HDD	Horizontal Directional Drilling
HMA	Hazard Management Agency
HR	Human Resources
IAP	Incident Action Plan
IC	Incident Controller/Commander
ICC	Incident Coordination Centre
IMMR	Inspection, Maintenance, Monitoring and Repair
IMT	Incident Management Team

Term	Definition
IR	Incident Response
LOWC	Loss of Well Control
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response (WA)
MNES	Matters Of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum Of Understanding
MSA	Master Services Agreement
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
OMP	Operational Monitoring Plans
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSC	On-Scene Commander
OSCP	Oil Spill Contingency Plan
OSM	Operational and Scientific Monitoring
OSM-BIP	Operational and Scientific Monitoring- Bridging Implementation Plan
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWR	Oiled Wildlife Response
PPA	Priority Protection Area
RCC	Rescue Coordination Centre (AMSA)
ROV	Remotely Operated Vehicle
SCAT	Shoreline Clean-up Assessment Technique
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SIMA	Spill Impact Mitigation Assessment
SLA	Service Level Agreement
SMP	Scientific Monitoring Plans
SMPC	State Marine Pollution Coordinator
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plans
STR	Shoreline Treatment Recommendations
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicle
VI	Varanus Island
VOC	Volatile Organic Compound
VOO	Vessels Of Opportunity
VPO	Vice President Offshore Upstream WA
WA	Western Australia
WAOWRP	Western Australian Oiled Wildlife Response Plan

Term	Definition
WSP	Waste Service Provider

1. Quick reference information

Parameter	Description	Further information
Petroleum Activity	The Reindeer facilities comprise the wellhead platform (WHP) infrastructure, three wells tied back to the WHP, one open ocean well that is permanently abandoned and approximately 43 km of the Devil Creek supply pipeline located in Commonwealth waters. The Devil Creek (DC) facilities comprise the approximately 48 km long state waters section of the DC supply pipeline, an approximately 11 km long onshore section of the DC supply pipeline to the Devil Creek Gas Plant (DCGP), and approximately 40 metres of onshore pipeline (DC sales gas pipeline) (collectively referred to as the DC pipelines herein) from the DCGP to the Dampier to Bunbury Natural Gas Pipeline (DBNGP). The petroleum activity comprises of any of the following: <u>Commonwealth Jurisdiction:</u> Operations phase: • Presence of infrastructure on title • Operation of the WHP and DC pipelines • Transporting dry unprocessed natural gas from the Reindeer field to DCGP via the DC pipelines • Vessel based activities associated with operations Cessation of Production (CoP) (preservation) phase: • CoP commences when the DC pipelines are filled with preservation fluid or nitrogen (N_2) • the DC pipelines remain filled with preservation fluid or N_2 • the Reindeer facilities will remain in preservation phase until a decision is made to either repurpose the facilities for CCS or decommission all, or part of the facilities • Activities including bird deterrence and inspection, maintenance, monitoring and repair (IMMR) may be undertaken during the operations phase or CoP phase. <u>State Jurisdiction</u> Operations Phase: • Ongoing presence of infrastructure onshore and offshore on title • Operation of the DC pipelines • Transporting dry unprocessed natural gas from the Reindeer field to DCGP via the DC pipelines Cessation of Production (CoP) Phase: • CoP commences when the DC pipeline is filled with preservation fluid or nitrogen (N_2) • the DC pipeline remains filled with preservation fluid or N2 • the DC pipelines will remain in preservation phase until a decision is made to either repurpose the facilities for CCS or decommission all, or part of the facilities <u>Inspection, maintenance, monitoring and repair (IMMR):</u> IMMR activities, including vessel-related activities, within the Operational Area will continue through the above phases.	Reindeer and Devil Creek Environment Plan (EP) Section 2
Location	The Reindeer WHP is located approximately 80 km northwest of the Port of Dampier, Western Australia (WA) in Commonwealth waters. The DC pipeline crosses Commonwealth and State waters and continues onshore as a buried pipeline until it reaches the DCGP. The DCGP is located approximately 10 km inland from Gnoorea Point and Forty Mile Beach.	Reindeer & DC EP Section 2.1 Figure 3-1
Petroleum title/s (Blocks)	The Reindeer WHP and Offshore Gas Supply Pipeline lie within Production License WA-41-L and WA-18-L. The WA State waters component of the pipeline lie within TPL/20.	N/A

<table>
<tr><th>Parameter</th><th colspan="3">Description</th><th>Further information</th></tr>
<tr><td>Mobile Offshore Drilling Unit (MODU)/Vessels</td><td colspan="3">Reindeer & DC operations involve the use of a support vessel for replenishment of chemicals, MDO fuel and potable water. Dedicated equipment-specific vessels may also be used.</td><td>Reindeer EP Section 2.4 and 2.6 and DC EP Section 2.5 and 2.7</td></tr>
<tr><td>Water depth</td><td colspan="3">0 to 58 metres (m)</td><td>N/A</td></tr>
<tr><td rowspan="4">Worst-case spill scenarios</td><td>Scenario</td><td>Hydrocarbon</td><td>Worst-case volume</td><td rowspan="4">Section 6.1</td></tr>
<tr><td>Surface loss of well control</td><td>Reindeer condensate</td><td>4,029 m^3</td></tr>
<tr><td>Hydrocarbon spill from loss of pipeline containment</td><td>Reindeer condensate</td><td>121.4 m^3</td></tr>
<tr><td>Surface spill from vessel collision</td><td>Marine Diesel Oil (MDO)</td><td>325 m^3</td></tr>
<tr><td rowspan="2">Hydrocarbon properties</td><td colspan="3">Reindeer condensate:
Density at 15 °C = 784.2 kg/m^3
Dynamic viscosity = 0.683 cP @ 20 °C
API Gravity = 48.9
Wax content = <5%
Pour point = -36 °C
Oil property classification = Non-Persistent (Group 1)</td><td rowspan="2">Appendix A</td></tr>
<tr><td colspan="3">MDO:
density at 15 °C = 890 kg/m^3
Dynamic viscosity = 14 @ 25 °C)
API Gravity = 27.5
Wax content = 1%
Pour point = −9 °C
Oil property classification = Persistent (light) (Group 2)</td></tr>
<tr><td rowspan="2">Weathering potential</td><td colspan="3">Reindeer condensate:
Reindeer condensate assay results show the condensate to be highly volatile with low viscosity. The weathering curve for Reindeer condensate indicates that a large proportion of the condensate will evaporate rapidly; approximately 74% of the volatile components, is expected to evaporate within the first 12 hours.</td><td rowspan="2">Appendix A</td></tr>
<tr><td colspan="3">MDO:
MDO is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Up to 40% will generally evaporate over the first two days. Approximately 5% is considered ‘persistent’, which is unlikely to evaporate, though it will decay over time.</td></tr>
<tr><td>Protection priorities</td><td colspan="3">Dampier Archipelago & Northern Islands Coast</td><td>Reindeer EP Section 3.2, 6.2, 7.5, 7.7 and 7.8
DC EP Section 3.2, 6.2, 7.7 and 7.8.</td></tr>
</table>

2. First-strike response actions

The initial response actions to major incidents at Devil Creek facilities are outlined within the Devil Creek Emergency Response Plan (DC-40-IF-00096). This includes site and role-specific information relevant to the initial stages of an incident response including notifying the Central Control Room (CCR), raising the alarm, mustering of personnel and emergency shutdown (ESD) of facility infrastructure. The Devil Creek Emergency Response Plan (DC-40-IF-00096) should be consulted as an overall guide to incident response at Devil Creek Facilities, which includes all major incidents additional to oil spills.

For hydrocarbon spills to the environment, the Emergency Commander (Facility OIM) is to contact the on-call IMT Duty Manager in Perth.

Following the initial actions undertaken by the Facility OIM / Vessel Master to ensure the safety of, and to control the source of the spill, the Facility OIM / Vessel Master will assess the situation based on:

- What has caused the spill?
- Is the source under control?
- What type of hydrocarbon was spilled?
- How much was spilled?

For spills from support vessels, initial response actions to major incidents are under the direction of the Vessel Master and in accordance with vessel-specific procedures (e.g. Shipboard Oil Pollution Emergency Plans [SOPEPs]).

Response information contained within this Oil Pollution Emergency Plan (OPEP) is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) is engaged for support and implementation of response strategies. Level 1 spills are managed through on-site response and the IMT is available to assist with regulatory requirements/notifications and support if required. Therefore, the immediate response actions listed in Table 2-1 are relevant for any spill. Once sufficient information is known about the spill, the Incident Commander at the Santos IMT in Perth will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the IMT Incident Commander.

For Level 2/3 spills from offshore petroleum facilities (petroleum activity spills) the Control Agency is Santos (Commonwealth waters), DoT (State waters) or both Santos and DoT (spill crossing between Commonwealth and State waters). Santos will provide first strike response and then work in coordination with DoT if DoT is required to assume Control Agency responsibilities. First strike activations for a level 2/3 offshore non-vessel spill are found below in Table 2-1.

The Devil Creek Emergency Response Plan (DC-40-IF-00096) and/or Reindeer First Strike Plan (both located on the Santos Emergency Response (ER) SharePoint) should be referred to alongside the first strike activations in Table 2-1.

Table 2-1: First-strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures or vessel-specific procedures, as applicable	Emergency Commander (Facility OIM) / Vessel Master
Immediate	Control the source using site resources, where possible	Implement site source control procedures or Vessel Shipboard Oil Pollution Emergency Plans (SOPEP) Refer to source control plan in Section 9	Emergency Commander (Facility OIM) / Vessel Master
30 minutes of incident being identified	Notify Santos Offshore Duty Manager/Incident Commander	Verbally communicate to Offshore Duty Manager/Incident Commander's duty phone	Emergency Commander (Facility OIM) / Vessel Master
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	Emergency Commander (Facility OIM) / Vessel Master
60 minutes	Gain situational awareness and begin on-site spill surveillance	Level 1 spills may only require the use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance). Refer to Monitor and Evaluate Plan in Section 10	Emergency Commander (Facility OIM) / Vessel Master / Incident Commander (Perth based IMT)
Refer to timeframes in Section 7	Notify regulators and stakeholders within specified timeframes	Activate the External Notifications and Reporting Procedures – Section 7	Initial notifications by Planning Section Chief – Section 7
Level 2/3 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Offshore Duty Manager/ Incident Commander
IMT actions (0 to 48 hours)			
Within 90 minutes from IMT call-out	Set up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive Incident Action Planning process Refer to Section 8 Review First-strike Activations (this table)	Incident Commander Planning Section Chief
Refer to timeframes in Section 7	Notify regulators and stakeholders as required Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required	Refer to Section 7	Initial notifications by Planning Section Chief Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)

When (indicative)	Activations		Who
	Objective	Action	
Refer to timeframes in Section 10	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Vessel Surveillance (Section 10.1) Aerial Surveillance (Section 10.2) Tracking Buoys (Section 10.3) Oil Spill Trajectory Modelling (Section 10.4) Satellite imagery (Section 10.5)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader Environment Unit Leader
Activate on Day 1 as applicable to the incident	Activate source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario dependent**	Activate the source control plan. Refer to Section 9	Operations Section Chief (Source Control Branch Director as appropriate to scenario) Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Section 11	Reduce exposure of shorelines and wildlife to floating oil through mechanical dispersion	Activate the Mechanical Dispersion Plan Refer to Section 11	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Section 16	Assess and monitor effectiveness of response strategies and impacts from spill and response	Activate the Santos North West Shelf Operational and Scientific Monitoring Bridging Implementation Plan (7715-650-ERP-0002) Refer to Section 16	Environment Unit Leader Logistics Section Chief/ Supply Unit Leader Operations Section Chief
Day 1	Identify environmental sensitivities at risk and conduct operational Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (Section 6.7)	Environment Unit Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan (Appendix N)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Day 1	Ensure the health and safety of spill responders	Identify relevant hazards controls and develop hazard register Begin preparing site health and safety management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Safety Officer
If/ when initiated Refer to Section 12	Protect identified shoreline protection priorities	Activate the Shoreline Protection and Deflection Plan Refer to Section 12	Operations Section Chief Logistics Section Chief /Supply Unit Leader Environment Unit Leader
If/ when initiated Refer to Section 15	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response (OWR) Plan Refer to Section 15	Environment Unit Leader Operations Section Chief

When (indicative)	Activations		Who
	Objective	Action	
			Logistics Section Chief/ Supply Unit Leader
If/ when initiated Refer to Section 13	Clean-up oiled shorelines	Activate Shoreline Clean-Up Plan Refer to Section 13	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
If/when initiated Refer to Section 17	Safely transfer, transport and dispose of waste collected from response activities	Activate the Waste Management Plan Refer to Section 17	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
IMT Actions (48+ hours)			
Ongoing	For ongoing incident management – indicatively 48 + hours – adopt a formal incident action planning process is to be adopted to continue with the spill response strategies identified above. An Incident Action Plan (IAP) is to be developed for each successive operational period. Santos will maintain control for those activities for which it is the designated Control Agency/ Lead IMT. Depending on the specifics of the spill, the Australian Maritime Safety Authority (AMSA) and/or Western Australia (WA) Department of Transport (DoT) may be relevant Control Agencies (see Section 4.2). If another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos' support to WA DoT (for a WA State waters response) is detailed in Section 4.7.1.		Control Agency IMT Santos to provide the following roles to DoT Maritime Environmental Emergency Coordination Centre (MEECC) / IMT for WA State waters response (refer to Table 5-5): • Crisis Management Team (CMT) Liaison Officer • Deputy Incident Controller • Deputy Intelligence Officer • Deputy Planning Officer • Environment Support Officer • Deputy Public Information Officer • Deputy Logistics Officer • Deputy Waste Management Coordinator • Deputy Finance Officer • Deputy Operations Officer • Deputy Division

3. Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (EP) WA-41-L and WA-18-PL (7715-650-EMP-0023) required by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Environment Regulations) and also the accompanying Oil Spill Contingency Plan (OSCP) to the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP) (onshore & State waters) (7715-650-EMP-0022-01) required by the Petroleum (Submerged Lands) (Environment) Regulations 2012.

3.1 Description of activity

This OPEP covers the continuous operational activities at the Reindeer WHP and associated 16” gas/condensate export pipeline (referred to as the DC supply pipeline). The DC supply pipeline runs from the WHP to the Devil Creek Gas Plant (DCGP) (Figure 3-1). This OPEP does not cover activities within the DCGP.

Gas and condensate is produced from the Reindeer gas field at the WHP, approximately 80 km northwest of the Port of Dampier, situated in 58 m water depth. The gas/condensate from production wells is transported ashore through the DC supply pipeline and processed at the DCGP. The DC supply pipeline crosses Commonwealth and State waters and continues onshore as a buried pipeline from the horizontal directional drilling (HDD) entrance point just offshore from the shoreline until it reaches the DCGP. The DC supply pipeline comprises 43 km in Commonwealth waters, 48 km in State waters and approximately 11 km onshore. Dry sales gas produced at the DCGP is fed into the Dampier Bunbury Natural Gas Pipeline (DBNGP), for industrial customers via the DC sales gas pipeline.

Operations covered by the OPEP include, but are not limited to the following:

- Production and transport of gas/condensate between the WHP and the DCGP via the DC supply pipeline
- Transport of dry sales gas from DCGP to DBNGP via the DC sales gas pipeline
- Inspections, surveys, maintenance and modifications of the WHP and DC pipelines (comprised of the DC supply pipeline and the DC sales gas pipeline)
- Vessel based operations supporting the above
- Transfer of personnel, equipment and chemicals to the WHP by vessel
- Cessation of production activities including flushing and filling of DC pipelines with preservation fluids or nitrogen and IMMR activities as needed.

A detailed description of the operational activities associated with the Reindeer WHP and associated pipeline are provided in the Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan WA-41-L and WA-18-PL (Reindeer EP; 7715-650-EMP-0023) and Devil Creek Gas Supply and Sales Gas Pipeline Operations Environment Plan (onshore & State waters) (Devil Creek EP; 7715-650-EMP-0022-01). A schematic overview of the Reindeer WHP and Devil Creek offshore and onshore gas supply pipeline is provided in Figure 3-2.

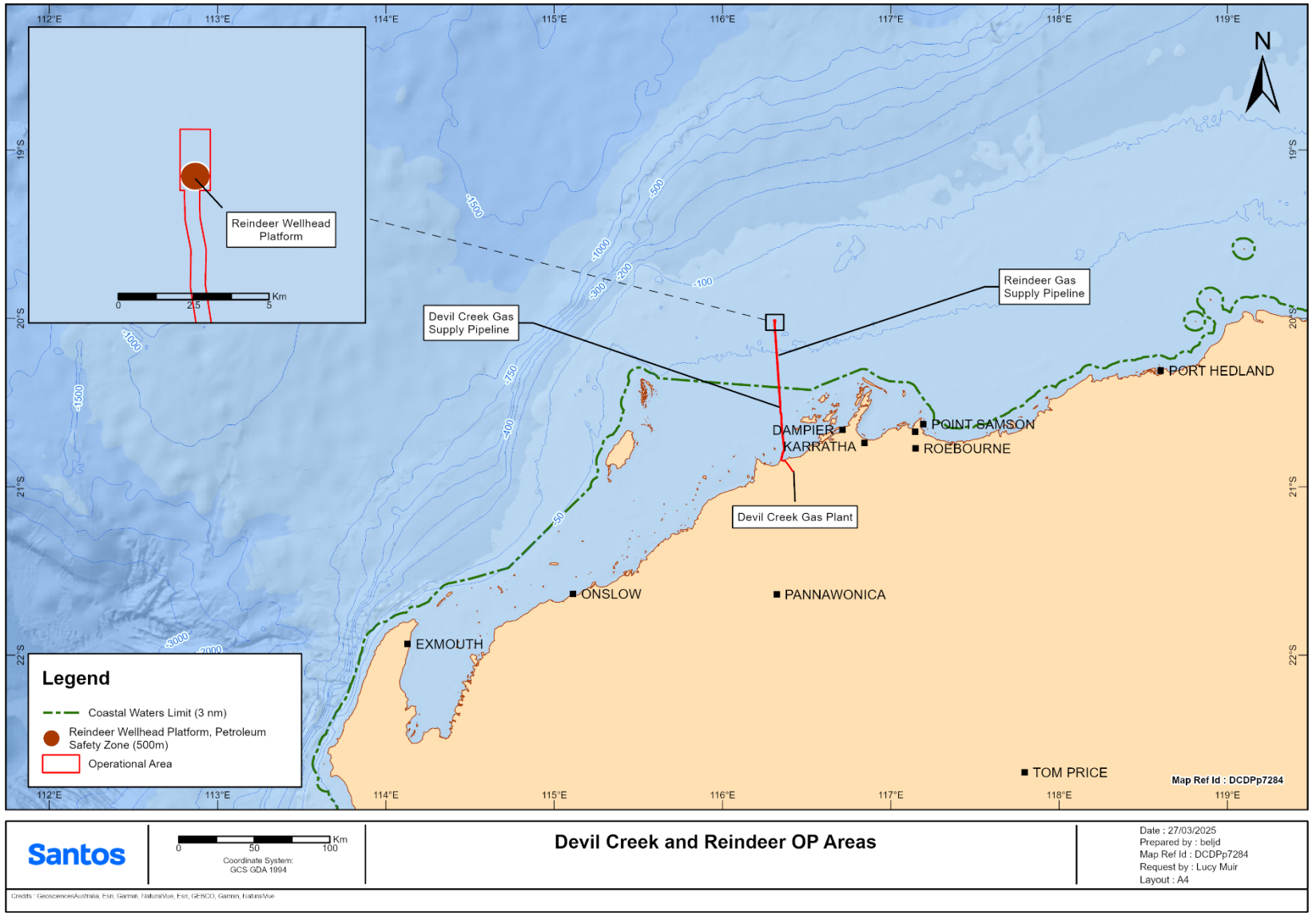

Figure 3-1: Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations EP (7715-650-EMP-0023) and Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations EP (onshore & State waters) (7715-650-EMP-0022-01) Operational Areas

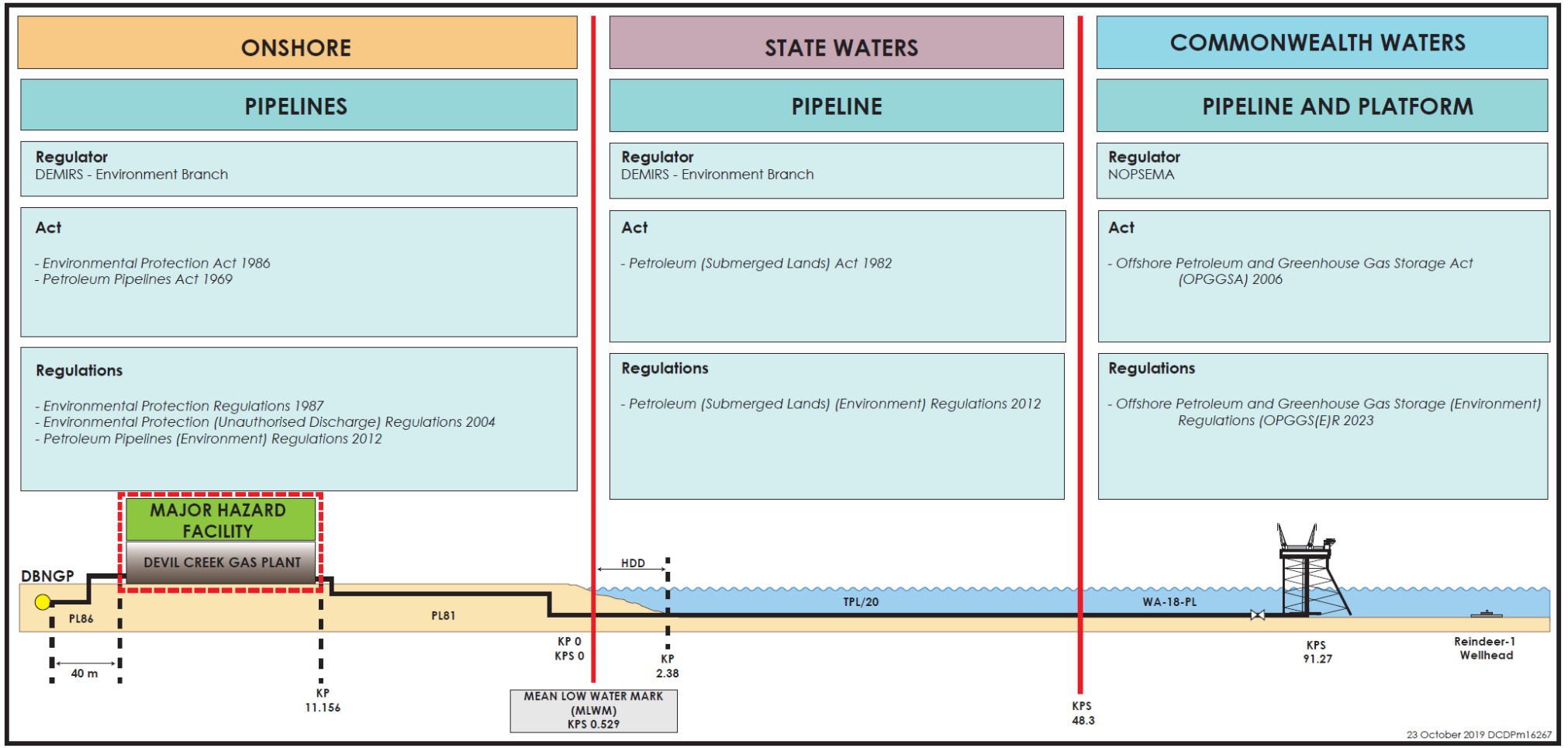

Figure 3-2: Schematic of the Reindeer WHP and Devil Creek Pipeline

3.2 Purpose

This OPEP describes Santos' response to a hydrocarbon spill during any activities associated with the operations, CoP and IMMR occurring at the Reindeer WHP or the DC pipelines stated in the relevant Environment Plans.

This OPEP was developed to meet all relevant requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 and the WA State Petroleum (Submerged Lands) (Environment) Regulations 2012. It is consistent with the Australian (national) and State (WA) systems for oil pollution preparedness and response, which are detailed in these documents:

- National Plan for Maritime Environmental Emergencies (AMSA 2020) managed by AMSA
- WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT 2024) and WA Incident Management Plan – (WA DoT 2023).

This OPEP is to be read in conjunction with the Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan WA-41-L and WA-18-PL (EP) (7715-650-EMP-0023) and the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (onshore & State waters) (EP) (7715-650-EMP-0022-01) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the EPs and will remain valid for 2.5 years under State legislation and 5 years under Commonwealth legislation.

The response strategies outlined in this OPEP have been developed by Santos using risk assessments to identify credible worst-case hydrocarbon spill scenarios, expected/calculated release rates, known information of hydrocarbon types and behaviour, and expected partitioning of the hydrocarbon within the marine environment with an estimate of the volume of persistent oil. This information has been modelled to give a theoretical zone of dispersion that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to 'as low as reasonably practicable' (ALARP). The response strategies are identified under a NEBA process so the most effective response strategies with the lowest environmental consequences can be identified, documented, and prepared for.

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos' IMT, so that it will direct its response effort with the aim of preventing long-term significant environmental impacts by safely limiting the adverse environmental effects from an unplanned release of hydrocarbons to the marine environment to a level that is ALARP. This will be achieved by implementing the various strategies and spill response mechanisms presented throughout this OPEP. Through this implementation, Santos will:

- initiate spill response immediately following a spill
- establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment
- assess the spill characteristics and understand its fate so as to make informed and clear response decisions
- monitor the spill to identify the primary marine and coastal resources requiring protection
- remove as much oil as possible from the marine environment while keeping environmental impacts from the removal methods to ALARP
- reduce the impacts of the remaining floating and stranded oil to ALARP
- respond to the spill using efficient response strategies that do not damage the environment
- comply with all relevant environmental legislation when implementing this OPEP
- conduct all responses safely without causing harm to participants
- monitor the impacts from a spill until impacted habitats have returned to baseline conditions
- remain in a state of 'Readiness' at all times for implementing of this OPEP by keeping resources ready for deployment, staff fully trained and completing response exercises as scheduled
- keep stakeholders informed of the status of the hydrocarbon spill response to help reduce socio-economic impacts.

3.4 Area of Operation

The Reindeer WHP is located approximately 80 km northwest of the Port of Dampier, Western Australia in Commonwealth waters (Figure 3-1). The DC supply pipeline crosses Commonwealth and State waters and continues onshore as buried pipeline until it reaches the DCGP. The DCGP is located approximately 10 km inland from Gnoorea Point and Forty Mile Beach.

The Reindeer facilities sit within production licence WA-41-L and WA-18-PL. The Commonwealth section of the pipeline sits within Pipeline Licence WA-18-PL, while the State sections of the pipeline sit within Pipeline Licence TPL/20 with an onshore pipeline within Pipeline Licence PL81. Section 3 of the Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan (EP) (7715-650-EMP-0023) and Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP) (7715-650-EMP-0022-01) include comprehensive descriptions of the existing environment.

3.5 Interface with internal documents

In addition to this OPEP, several other Santos documents provide guidance and instruction relevant to spill response, including:

- Santos Incident Management Plan – WANATL (7700-650-PLA-0016)
- Santos Incident Management Handbook
- Santos Crisis Management Plan (SMS-HSS-OS05-PD03)
- Reindeer WHP Operations Environment Plan (EA-14-RI-10002.01)
- Devil Creek Offshore Gas Supply Pipeline Operations Environment Plan (EA-14-RI-10001.01)
- Devil Creek Emergency Response Plan (DC-40-IF-00096)
- Reindeer First Strike Plan
- FES Emergency Response Guide (DC-40-IF-000990)
- Incident Response Telephone Directory 7700-650-PLA-0016.20)
- Environment Incident Notification Guideline and Matrices (QE-91-HF-10003)
- Source Control Planning and Response Guideline (DR-00-OZ-20001)
- Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038)
- 16” Reindeer Pipeline Operational Safety Case and Pipeline Management Plan (RE-14-RF-00036.02)
- Reindeer Schlumberger Report 1-1BAORA3
- Reindeer Source Control Plan Rev0 (28th Sept 2017)
- NWA Waste Management Plan – Oil Spill Response Support (7715-650-ERP-0001)
- Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
- Santos Offshore Division Incident and Crisis Management Exercise and Training Plan (SO-92-HG-10001)
- Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
- Santos North West Shelf Operational and Scientific Monitoring – Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0002)
- Santos Offshore Division Oil Spill Response Readiness Guideline (7710-650-GDE-0001)
- Santos Offshore - Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
- Santos Offshore - Oil and Water Sampling Procedures (7710-650-PRO-0008)
- Santos Oil Spill Response - Forward Operating Base Guideline (SO-91-IF-20017).

3.6 Interface with external documents

Information from the following external documents have been used or is referred to in this OPEP:

- AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
- Offshore Petroleum Incident Coordination Framework
  - provides overarching guidance on the Australian Government's role and responsibilities in the event of an offshore petroleum incident in Commonwealth waters
- National Plan for Maritime Environmental Emergencies & National Marine Oil Spill Contingency Plan
  - sets out national arrangements, policies and principles for managing maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
- Western Australia State Hazard Plan: Maritime Environmental Emergencies (SHP-MEE)
  - details the management arrangements for preparing for and responding to maritime environmental emergencies occurring in State waters.
- WA DoT Incident Management Plan – Marine Oil Pollution
  - provides the WA DoT, as the hazard management agency (HMA) for marine oil pollution (MOP), with an incident management plan that outlines the procedures and arrangements for responding to MOP incidents occurring within or impacting WA State waters
  - WA DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (go to: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements).
- Western Australia Oiled Wildlife Response Plan (WAOWRP)
  - establishes the framework for responding to potential or actual wildlife impacts in WA State waters, within the framework of an overall maritime environmental emergency
  - outlines risk reduction strategies, preparedness for, response to and initiation of recovery arrangements for wildlife impacts during a marine oil pollution incident.
- Western Australia Oiled Wildlife Response Manual
  - a companion document to the WAOWRP for Maritime Environmental Emergencies, designed to standardise operating procedures, protocols and processes for wildlife response.
- Joint Industry Operational and Scientific Monitoring Framework
  - provides a standardised approach to oil pollution monitoring, including industry guidance, templates, worked examples and standardised Operational and Scientific Monitoring Plans that titleholders can apply to identify and detail monitoring arrangements and capabilities in their EP and OPEP submissions.
- Shipboard Oil Pollution Emergency Plans (SOPEPs)
  - under MARPOL Annex I requirements, all vessels of over 400 gross tonnage must have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
- Oil Spill Response Limited (OSRL) Associate Agreement
  - defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
- Western Australia State Hazard Plan for Hazardous Materials Emergencies (HAZMAT)
  - details the emergency management arrangements for hazardous materials emergencies throughout the State of Western Australia
- Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - provides a framework for coordinating of Australian Government departments and agencies in response to maritime environmental emergencies.

- Pilbara Ports Authority Port of Dampier Handbook (Pilbara Ports Authority, 2024) (https://www.pilbaraports.com.au/about-pilbara-ports/publications/forms-and-publications/forms-and-publications/handbook/2024/february/port-of-dampier-handbook)
  - defines the requirements for marine oil pollution reporting within the Port of Dampier limits.
- Pilbara Ports Authority Port of Ashburton Handbook (Pilbara Ports Authority, 2022) (https://www.pilbaraports.com.au/about-ppa/publications/forms-and-publications/forms-publications/handbook/2022/may/port-of-ashburton-port-handbook)
  - defines the requirements for marine oil pollution reporting within the Port of Ashburton limits.
- Port of Varanus Island Port Handbook (Pilbara Port Authority 2021a (https://www.pilbaraports.com.au/about-pilbara-ports/publications/forms-and-publications/forms-and-publications/handbook/2021/july/port-of-varanus-island-handbook)
  - defines the requirements for marine oil pollution reporting within the Port of Varanus Island limits
- Pilbara Ports West Marine Pollution Contingency Plan (MPCP) (Pilbara Ports Authority, 2021b) (https://www.pilbaraports.com.au/about-ppa/publications/forms-and-publications/forms-publications/form/2021/july/pilbara-ports-west-marine-pollution-contingency-pl)
  - provides a source of information for individuals and agencies responsible for developing and managing oil spill response capabilities within Pilbara Ports West port limits.

3.7 Document review

In line with regulatory requirements, this document shall be reviewed, updated and submitted to Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) every 2.5 years from date of acceptance, until the activity is complete. Further, in line with Commonwealth regulatory requirements, this document shall be reviewed, updated and submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) every 5 years from date of acceptance, until the activity is complete.

The document may be reviewed and revised more frequently, if required, in accordance with the Santos Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

- when major changes have occurred that affect oil spill response coordination or capabilities
- changes to the Environment Plan that affect oil spill response coordination or capabilities (e.g. a significant increase in spill risk)
- following routine testing of the OPEP if improvements or corrections are identified
- after a Level 2/3 spill incident.

The extent of changes made to the OPEP and resultant requirements for regulatory resubmission will be informed by the relevant regulations, i.e. the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 and the Petroleum (Submerged Lands) (Environment) Regulations 2012.

3.8 OPEP custodian

The Custodian of the OPEP is the Santos Lead Oil Spill Risk & Planning Coordinator based in the Santos Perth Office.

4. Spill management arrangements

4.1 Response levels and escalation criteria

Santos uses a tiered system of 3 incident response levels consistent with the National Plan for Maritime Environmental Emergencies (AMSA 2020) and the WA SHP-MEE (WA DoT 2024). Spill response levels help identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined in the Santos Incident Management Plan – WANATL (7700-650-PLA-0016) and further detailed in Table 4-1 for hydrocarbon spills.

Table 4-1: Santos oil spill response levels

Level 1	
An incident that will not have an adverse effect on the public or the environment which can be controlled using resources normally available onsite without the need to mobilise the Santos IMT or other external assistance.	
• Spill is contained within the incident site. • Spill occurs within immediate proximity to the site. • Incident can be managed by the Emergency Response Team (ERT) and its resources.	• Source of spill has been contained. • Oil is evaporating quickly and no danger of explosive vapours. • Spill likely to naturally dissipate. • No media interest/no adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or **An incident that can be controlled onsite but which may have an adverse effect on the public or the environment.**	
• Danger of fire or explosion. • Possible continuous release. • Concentrated oil accumulating close to the site or vessel. • Potential to impact other installations.	• Level-1 resources overwhelmed, requiring additional regional resources. • Potential impact to sensitive areas and/or local communities. • Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident that has a wide ranging impact on Santos and may require the mobilisation of external state, national or international resources to bring the situation under control.	
• Loss of well integrity. • Actual or potentially serious threat to life, property, industry. • Major spill beyond site vicinity. • Significant shoreline environmental impact.	• Level-2 resources overwhelmed, requiring international assistance. • Level- 3 resources to be mobilised. • Significant impact on local communities. • International media attention.

4.2 Jurisdictional authorities and control agencies

The responsibility for an oil spill depends on the spill's location and its origin. The National Plan for Maritime Environmental Emergencies (AMSA 2020) sets out the divisions of responsibility for an oil spill response. Definitions of Control Agency and Jurisdictional Authority are as follows:

- **Control Agency:** the organisation assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency. Control Agencies have the operational responsibility of response activities but may have arrangements in place with other parties to provide response assistance under their direction.
- **Jurisdictional Authority:** the agency responsible for verifying that an adequate spill response plan is prepared and, in the event of an incident, that a satisfactory response is implemented. The Jurisdictional Authority is also responsible for initiating prosecutions and the recovery of clean-up costs on behalf of all participating agencies.

Table 4-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State waters and for vessel and petroleum activity spills.

To help determine a vessel versus a petroleum activity spill, the following guidance is adopted:

State waters:

- An offshore petroleum operation includes commissioning, operating or maintaining an offshore petroleum site and constructing, commissioning, operating or maintaining administrative or other support facilities at or in the vicinity of an offshore petroleum site, as defined by Section 4A (4)(b &d) of the *Petroleum (Submerged Lands) Act 1982.*
- An offshore petroleum activity does not include providing supplies to a vessel or structure or otherwise travelling between a vessel or structure and the shore, as defined by Section 5(c) of the *Petroleum (Submerged Lands) Act 1982*.

Commonwealth waters:

- A vessel is a ship at sea to which the Commonwealth *Navigation Act 2012* applies. Defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA 2017a) as a seismic vessel, supply or support vessel, or offtake tanker.
- A petroleum activity includes facilities such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure for the recovery of petroleum, for the processing of petroleum, or for the storage and offloading of petroleum, or for any combination of those activities and for any other purpose related to offshore petroleum operations , as defined by Schedule 3, Part 1, Clause 4 and Volume 2, Part 6.8, Section 640 of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act 2006).

Table 4-2: Jurisdictional and control agencies for hydrocarbon spills

Jurisdictional boundary	Spill source	Jurisdictional Authority	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	WA DoT	WA DoT	WA DoT	• Vessel SOPEP • State Hazard Plan: Maritime Environmental Emergencies (WA DoT 2024) • WA Incident Management Plan Marine Oil Pollution (WA DoT 2023)
	Petroleum activities	WA DoT	Titleholder	WA DoT	• State Hazard Plan: Maritime Environmental Emergencies (WA DoT 2024)
WA State Waters within Pilbara Port Authority Limits[1]	Vessel	WA DoT	Port Authority[2]	Port Authority / DoT[3]	• Port of Varanus Island Port Handbook (Pilbara Port Authority 2021a) • Pilbara Ports West – Marine Pollution Contingency Plan (Pilbara Port Authority 2021b) • Port of Ashburton Port Handbook (Pilbara Port Authority 2022) • State Hazard Plan: Maritime Environmental Emergencies (WA DoT 2024)
	Petroleum activities	WA DoT	Port Authority	DoT	• State Hazard Plan: Maritime Environmental Emergencies (WA DoT 2024)
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel[4]	AMSA	AMSA		• Vessel SOPEP • National Plan
	Petroleum activities[5]	NOPSEMA	Titleholder		• Devil Creek Pipeline and Reindeer Well Head Platform OPEP

[1] The Varanus Island port limits are defined in section 4 of the Port of Varanus Island Port Handbook (Pilbara Port Authority 2021a).

[2] DoT and the Port Authority may assign, through IMPs/OSCPs/OPEPs, emergency response functions to a Port Operator or Port Facility Operator for spills originating from their activities, however the role of Control Agency will remain with the nominated agency or organisation as per Table 4-2 above (Pilbara Port Authority 2021a).

[3] For any incident originating in Port Authority waters, the relevant Port Authority will be the Controlling Agency, unless for Level 2 and 3 incidents it is deemed by the HMA/SMPC in consultation with the Port Authority that it is more suitable for DoT to be the Controlling Agency (WA DoT, 2024).

[4] Vessels are defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA 2017a) as a seismic vessel, supply or support vessel. Note: this definition does not apply to WA State waters.

[5] A petroleum activity includes facilities such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure for the recovery of petroleum, for the processing of petroleum, or for the storage and offloading of petroleum, or for any combination of those activities and for any other purpose related to offshore petroleum operations, as defined by Schedule 3, Part 1, Clause 4 and Volume 2, Part 6.8, Section 640 of the OPGGS Act 2006.

4.3 Petroleum activity spill in State Waters

If a Marine Oil Pollution Incident occurs within State waters, the DoT is the Hazard Management Agency (HMA) (DoT Chief Executive Officer or proxy). The Director Maritime Environmental Emergency Response (MEER) & Ports has been nominated by the HMA to perform the role of State Marine Pollution Coordinator (SMPC) (as prescribed in Section 1.3 of the SHP – MEE (WA DoT 2024). Under the SHP-MEE, the Control Agency for Level 1 Petroleum Activity spills in State waters is the Petroleum Titleholder (Santos) with the Control Agency for Level 2/3 spills nominated as DoT. During a MEE incident within State and Port Waters, the role of the SMPC provides strategic management of the incident response on behalf of the HMA.

Whilst Santos is not the Control Agency for Level 2/3 Petroleum Activity spills in State waters, Santos is required to have adequate plans and resources available to respond to a worst-case spill originating in State waters under the following State petroleum legislation administered by DEMIRS:

- *Petroleum (Submerged Lands) Act 1982* and Petroleum (Submerged Lands) (Environment) Regulations 2012
- *Petroleum Pipelines Act 1969* and Petroleum Pipelines (Environment) Regulations 2012

Where DoT has assumed the role of Control Agency, Santos will provide all necessary resources to assist DoT. The framework under which Santos will provide support to DoT for an oil spill response within State waters is detailed in Section 4.7.1.

4.4 Petroleum activity spill in Commonwealth Waters

For an offshore petroleum activity spill, the Jurisdictional Authority is NOPSEMA, which is responsible for overseeing response actions to pollution events from offshore petroleum activities in areas under Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the OPGGS Act 2006 and OPGGS (E) Regulations, including the issuing of directions as required, and investigate accidents, occurrences and circumstances involving deficiencies in environmental management.

Under the OPGGS Act 2006 and OPGGS (E) Regulations, the petroleum titleholder (i.e. Santos) is responsible for responding to an oil spill incident as the Control Agency in Commonwealth waters, in accordance with its OPEP.

4.5 Vessel spills

In all circumstances, the Vessel Master is responsible for implementing source control arrangements detailed in the vessel-specific SOPEP.

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a supporting agency throughout the response. This includes providing essential services, personnel, materials or advice in support of the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (Section 10) and Operational and Scientific Monitoring (Section 16).

4.5.1 Commonwealth Waters

For a vessel incident originating in Commonwealth Waters the Jurisdictional Authority and Control Agency is AMSA. AMSA is the national shipping and maritime industry regulator and was established under the *Australian Maritime Safety Authority Act 1990*. AMSA manages the National Plan on behalf of the Australian Government, working with State and the Northern Territory governments, emergency services and private industry to maximise Australia's marine pollution response capability.

As with petroleum activity spills, Santos is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within Commonwealth waters under OPGGS Act 2006 and OPGGS (E) Regulations.

Santos will be responsible for coordinating a first-strike response to a vessel-based spill in Commonwealth waters until AMSA takes over the role as Control Agency, at which time Santos would provide all available resources as a Supporting Agency.

4.5.2 State Waters

For a vessel incident originating in State Waters the Jurisdictional Authority/ Hazard Management Agency is DoT. DoT is also the Control Agency for Level 2/3 vessel spills in State waters under SHP-MEE arrangements.

As with petroleum activity spills, Santos is required to have adequate preparedness arrangements for spills from vessels undertaking petroleum activities within State Petroleum legislation administered by DEMIRS.

Santos will be responsible for coordinating a first-strike response to all vessel-based spills until DoT takes over the role as Control Agency, in the event of a Level 2/3 spill, at which time Santos would provide all necessary resources (including personnel and equipment) as a Supporting Agency.

4.6 Cross-jurisdictional spills

4.6.1 Cross-jurisdictional petroleum activity spills

For a Level 2/3 Petroleum Activity spill, there is the possibility of the spill crossing jurisdictions between Commonwealth and State waters. In these instances, the Jurisdictional Authority remains true to the source of the spill (i.e. NOPSEMA for Commonwealth waters and DoT for State waters). Where a Level 2/3 spill originating in Commonwealth waters moves into State waters two Control Agencies will exist: DoT and the Petroleum Titleholder (Santos), each with its own Incident Management Team (IMT) and Lead IMT responsibilities.

The arrangements between DoT and Santos for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in Section 4.7.

4.6.2 Cross-jurisdictional vessel spills

For a large vessels spill (Level 2/3) that crosses Jurisdictions between Commonwealth and State waters two Jurisdictional Authorities exist; AMSA for Commonwealth waters and DoT for State waters. Coordination of Control Agency responsibilities will be determined by DoT and AMSA, based on incident specifics with Santos providing all necessary resources (including personnel and equipment) as a supporting agency, as detailed in Section 4.7.

AMSA may request that DoT manage a vessel incident in Australian Commonwealth waters (WA DoT 2024).

4.6.3 Onshore spills

In the event of a hydrocarbon spill along the onshore section of Santos's Devil Creek Pipeline, the Jurisdictional Authority and Hazard Management Agency (HMA) for incident response is the Department of Fire and Emergency Services (DFES). The DFES is the prescribed HMA for response under the Emergency Management Regulations 2006 for all emergencies in which there is an "actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment".

The DFES will respond as Control Agency in accordance with the State Hazard Plan: Hazardous Materials Emergencies (HAZMAT), which includes emergencies at or involving onshore pipelines licensed pursuant to the *Petroleum Pipelines Act 1969* (Section 1.2.2 (c)).

Notwithstanding this, Santos is required to have adequate plans and resources available to effectively respond to a worst-case spill originating from its pipelines as per the *Petroleum Pipelines Act 1969* and Petroleum Pipelines (Environment) Regulations 2012. Santos will provide first strike response until such time as DFES assumes control.

As stated in the HAZMAT on-site recovery and clean-up of hazardous materials is the responsibility of the owner and as such, Santos will ensure clean-up and remediation of any onshore spill is completed to the satisfaction of the Department of Water and Environmental Regulation (DWER) as the relevant Jurisdictional Authority for the clean-up of onshore oil spill pollution and management of contaminated sites.

4.7 Integration with government organisations

4.7.1 Western Australia – Department of Transport

For Level 2/3 spills entering or within WA State waters/shorelines, DoT as the Control Agency is the ultimate decision maker regarding identification and selection of protection priorities. DoT will utilise their internal processes which typically includes the following:

- evaluation of situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder
- evaluation of resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Commonwealth government databases or other information sources
- evaluation of shoreline types, habitat types and seasonality of environmental, socio-economic and cultural values and sensitivities

- consultation with the State Environmental Scientific Coordinator and other relevant State and Federal government departments with environmental responsibilities
- consultation with other relevant oil spill agencies, including the AMSA Environment, Science and Technology network or any other experts as necessary
- all information is utilised in a NEBA/ Spill Impact Mitigation Assessment (SIMA) type process, to determine protection priorities and response strategies.

DoT will adjust/amend their internal processes to suit the spill situation at the time.

Santos will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring) if an actual or impending spill occurs within or may impact WA State waters. On notification, the SMPC will activate their MEECC and the DoT IMT. Titleholders will work in partnership with DoT during such instances, as outlined within the DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (WA DoT 2020).

Santos will conduct initial response actions in State waters as necessary in accordance with its OSCP and continue to manage those operations until formal handover of incident control in State Waters is completed. Appendix 1 in DoT's Offshore Petroleum Industry Guidance Note (WA DoT 2020) provides a checklist for formal handover. Beyond formal handover, Santos will continue to provide all necessary resources, including personnel and equipment, to assist the DoT in performing duties as the Control Agency for State Waters.

For a cross-jurisdictional response, there will be a Lead IMT (DoT or Santos) for each spill response activity, noting that DoT only has jurisdictional/control agency authority within State waters.

Appendix 2 in DoT's Offshore Petroleum Industry Guidance Note (WA DoT 2020) provides guidance on the allocation of a Lead IMT to response activities for a cross-jurisdictional spill.

To facilitate coordination between DoT and Santos during a cross-jurisdictional response, a Joint Strategic Coordination Committee will be established. The Joint Strategic Coordination Committee will be jointly chaired between the SMPC and a nominated senior representative of Santos and will ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests.

For a cross-jurisdictional response Santos will be responsible for ensuring adequate resources are provided to DoT as Control Agency, initially 11 personnel to fill roles in the DoT IMT or Forward Operating Bases (FOB) (refer to Section 5.2) and operational personnel to assist with those response strategies where DoT is the Lead IMT. Concurrently DoT will also provide two of their personnel to the Santos IMT as described in Table 5-2. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attend the DoT Fremantle Incident Control Centre (ICC) as soon as possible after the formal request has been made by the SMPC. It is an expectation that the remaining initial cohort will attend the DoT Fremantle ICC no later than 8am on the day following the request being formally made to Santos by the SMPC. Santos personnel designated to serve in DoT's FOB will arrive no later than 24 hours after receipt of formal request from the SMPC.

Figure 4-1 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DoT's MEECC/ IMT.

Figure 4-2 shows the overall cross-jurisdictional organisational structure referenced from the SHP-MEE.

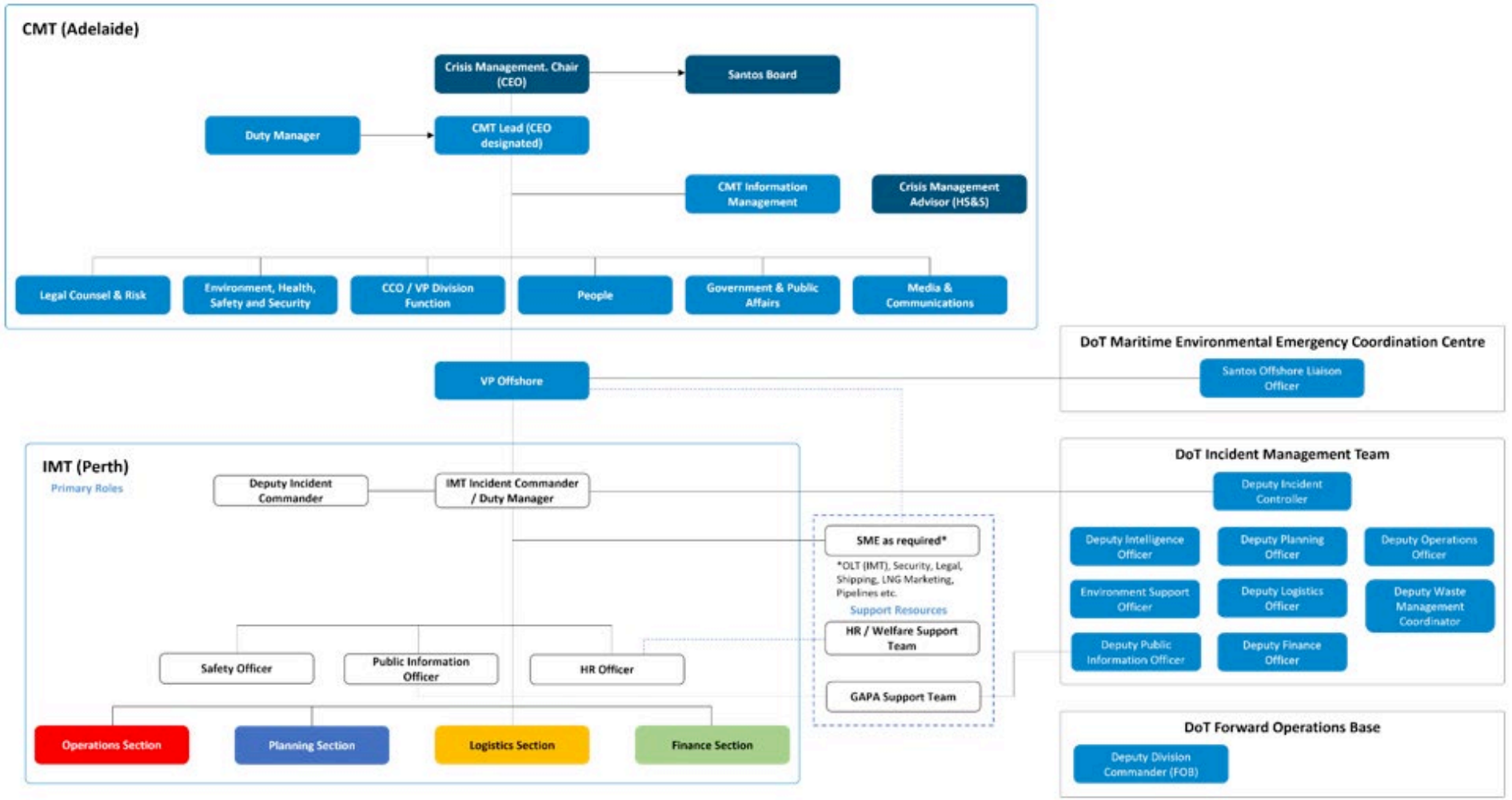

Figure 4-1: Santos cross-jurisdictional incident management structure for a Level 2/3 facility oil pollution incident originating within or entering WA State waters

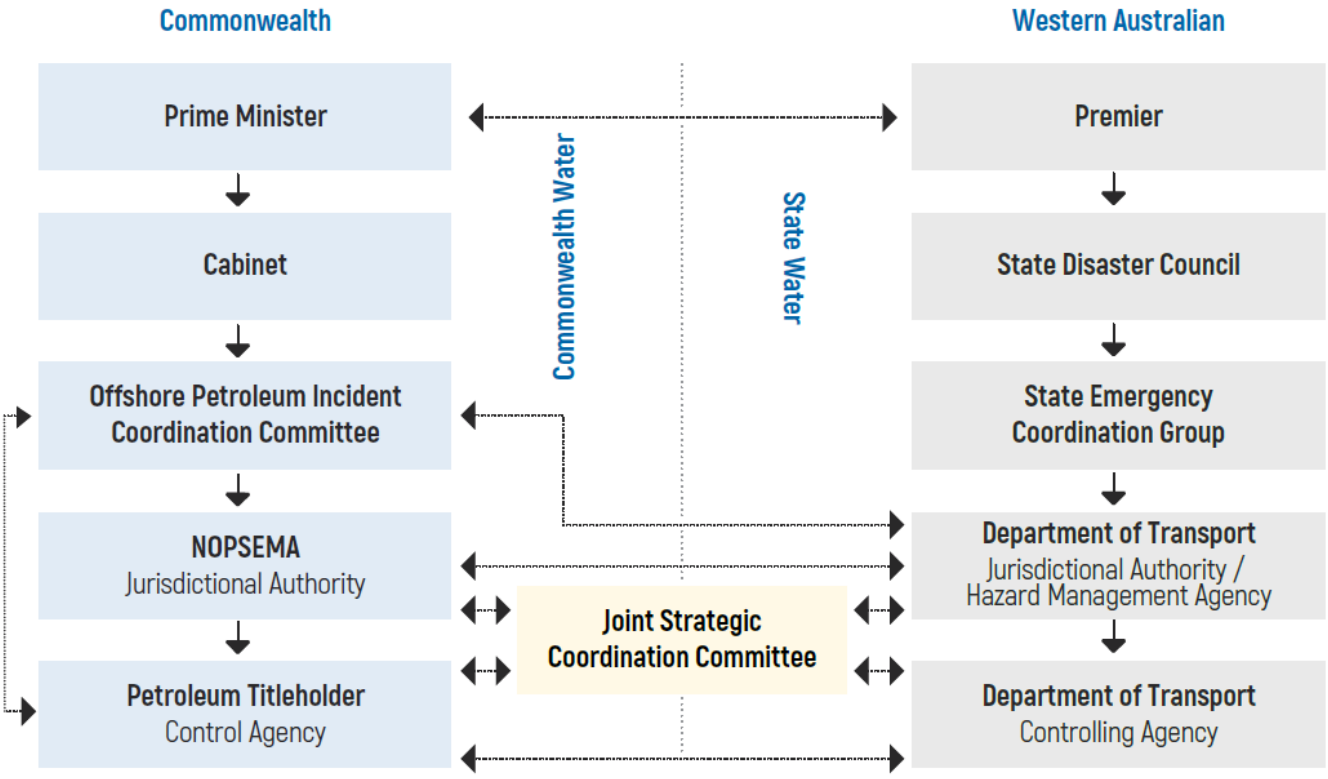

Figure 4-2: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

Source: WA DoT 2024

4.7.2 Australian Maritime Safety Authority

Although DoT and Santos would be Control Agencies initially for any spill in State waters (as outlined in Section 4.2), AMSA is the designated Control Agency for vessel spills in Commonwealth waters. Therefore, should a vessel spill enter Commonwealth waters, AMSA may also become a (or the) Control Agency. Arrangements for coordination and potential transfer of Control Agency status are outlined in AMSA Guidance Note NP-GUI-023: Coordination of Cross-Border Incidents (AMSA 2017b).

AMSA is to be notified immediately of all ship-source incidents through the AMSA Rescue Coordination Centre (RCC) Australia (Santos Incident Response Telephone Directory [SO 00 ZF 00025.020]).

AMSA manages the National Plan, Australia's key maritime emergency contingency and response plan (AMSA 2020). AMSA fulfils its obligations under the National Plan for non-ship source pollution incidents on the formal request from the respective Offshore Petroleum Incident Controller/s (AMSA 2021). AMSA also has a range of National Plan supporting documents containing related policies, guidance and advisory information.

For any oil pollution event, Santos agrees to notify AMSA immediately in the interests of facilitating the most efficient and effective response to the incident.

4.7.3 Western Australian Department of Biodiversity, Conservation and Attractions

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) has responsibilities associated with wildlife and activities in national parks, reserves and State marine parks. The *Biodiversity Conservation Act 2016* (WA) is the legislation that provides DBCA with the responsibility and Statutory Authority to treat, protect, and destroy wildlife. In State waters, DBCA is the Jurisdictional Authority for Oiled Wildlife Response (OWR), providing advice to the Control Agency (DoT). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) (DBCA 2022a).

For a Level 2/3 petroleum spill that originates within or moves into State waters, DoT will be the Control Agency responsible for overall command of an oiled wildlife response. Santos will provide all necessary resources (equipment and personnel primarily through AMOSC membership) to DoT to facilitate this response.

Any deterrence, displacement or rescue activity involving wildlife in WA (living or dead) constitutes "disturbance" or "taking" of wildlife under the *Biodiversity Conservation Act 2016* and will require authorisation through DBCA unless undertaken by licensed personnel. The DBCA Oiled Wildlife Advisor (OWA) will expedite the process of granting

interim licences or other authorities to undertake approved activities. No action specifically targeted at wildlife should occur without this authority. Deceased animals' disposal will be managed in accordance with the DBCA's WAOWRP which describes the process for disposal of dead animals/carcasses. Initially, the granting of authority to take deceased wildlife is likely to be via a direction from a DBCA wildlife officer while the appropriate licences or licence holder/s that the animals can be held by are identified and organised.

For matters relating to environmental sensitivities and scientific advice in State waters DBCA may provide an Environmental Scientific Coordinator (ESC) to support the SMPC and/or DoT Incident Controller.

This may include advice on priorities for environmental protection, appropriateness of proposed response strategies and the planning and coordination of operational monitoring for response effectiveness evaluation, and planning scientific monitoring for impact and recovery assessment.

4.7.4 Department of Industry, Science and Resources

The Department of Industry, Science and Resources (DISR) will be the lead Commonwealth Agency for the provision of strategic oversight and Commonwealth government support to a "Significant" offshore petroleum incident (including oil spill incidents). DISR will be notified by NOPSEMA of a significant oil pollution incident and under the Offshore Petroleum Incident Coordination Framework will stand up the Offshore Petroleum Coordination Committee as the mechanism to provide Commonwealth strategic advice and support to the incident. To facilitate information between the petroleum titleholder IMT and Offshore Petroleum Incident Coordination Committee, Liaison Officer/s will be deployed from DISR to the petroleum titleholder IMT.

For incidents that are classified at a greater level than "Significant" (i.e. crisis level), a whole of government crisis committee will be formed under the Australian Government Crisis Management Framework to provide strategic advice and support and the Offshore Petroleum Incident Coordination Committee will not be convened, although DISR will remain as the lead agency.

4.7.5 WA Department of Fire and Emergency Services (DFES)

In the event of a release of hydrocarbon (gas/condensate) from the Devil Creek pipeline onshore section, DFES will be engaged as per the Devil Creek Emergency Response Plan (DC-40-IF-00096) and may assume responsibilities, including the nomination of an Incident Controller, as a Combat Agency under Emergency Management Regulations 2006 and as outlined within the HAZMAT. DFES will then notify or activate the State HAZMAT Emergency Advisory Team (HEAT) to provide advice to the Incident Controller on appropriate response strategies for the hazardous material.

DFES will advise once control of the emergency situation and hazardous material has been established and when the site is safe for recovery by non-emergency services. At this point in time Santos will take control of the site recovery under the supervision of DWER.

4.7.6 Department of Water and Environmental Regulation (DWER)

For an onshore spill, the direct on-site recovery and clean-up of the hydrocarbon pollution is the responsibility of the owner of the hazardous material (Santos). DWER have responsibilities under the *Environmental Protection Act 1986* to ensure that the pollution is cleaned up by the owner. DWER administers the *Contaminated Sites Act 2003* and may declare and supervise the clean-up of, a Contaminated Site, as a result of oil pollution.

4.8 Interface with external organisations

Santos has contracts in place enabling access to Oil Spill Response Organisations (OSROs). OSROs have put specific measures in place to ensure that they are able to continue to meet their commitments to members. This support can be provided directly or remotely to aid the IMT and/or ERT.

4.8.1 Australian Marine Oil Spill Centre

Santos is a Participating Company of AMOSC and as such has access to AMOSC equipment and personnel as outlined in the AMOSPlan (AMOSC 2021).

AMOSC has contracts with all its member companies to enable the immediate release of Core Group personnel to be made available for any Santos requirements, as outlined in Santos' *Master Service Contract* and *Principle and Agency Agreement* with AMOSC.

The mutual aid arrangements that AMOSC operates under are collaborated under the AMOSPlan. This provides the mechanism for members of AMOSC to access oil spill response capability of other members. To further enhance the mutual aid arrangements, Santos, Chevron, Woodside and Jadestone have signed a Memorandum of Understanding (MoU) that defines the group's mutual aid arrangements. Under this MoU, Santos, Chevron,

Woodside and Jadestone have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

4.8.2 Oil Spill Response Limited

Through an associate membership, Santos has access to spill response services from OSRL with offices in Perth, Singapore, UK and at other various locations around the globe. In the event of a Level 2/3 response, Santos could access OSRL's international personnel, equipment and dispersants to supplement resources available within Australia. Santos may also call on OSRL for technical services to support its IMT.

Under the OSRL Associate membership Service Level Agreement (SLA), Santos has access to response personnel (18 personnel per incident) and 50% of the global response equipment stockpile. In addition to this, Santos is also a member of OSRL's Global Dispersant Stockpile (GDS) and Operational and Scientific Monitoring (OSM) Services Supplementary Agreement.

The GDS Supplementary Agreement provides Santos with access to 5,000 m^3 of dispersant stockpile in addition to the dispersant stockpile available under the Associate membership SLA. The OSM Services Supplementary Agreement provides Santos with access to OSM services. Additional information on OSM services and capability is provided in Section 16 and in the Santos North West Shelf OSM-BIP (7715-650-ERP-0002).

4.8.3 Pilbara Ports Authority

Pilbara Ports Authority has established an overarching Marine Pollution Contingency Plan (MPCP) for Pilbara Ports (Pilbara Ports Authority, 2021), which covers all Pilbara Ports West waters. The MPCP is a source of information for those individuals and agencies that are responsible for developing and managing oil spill response capabilities within Pilbara Ports West port limits, which includes the Port of Varanus Island, Port of Dampier and the Port of Ashburton.

In late 2023 WA DoT has developed a guidance note for WA ports on response and collaboration arrangements during maritime environmental emergencies including oil spills that impact port waters. This Guidance Note outlines the roles and responsibilities of the Department of Transport (DoT), and Port Authorities or Port Operators under those arrangements and seeks to promote consistency between Port Authority and Port Operator provisions for the management of Marine Oil Pollution (MOP) or Marine Transport Emergency (MTE) incidents within Port waters, and the overarching arrangements for WA as outlined in the State Hazard Plan – Maritime Environmental Emergencies (SHP-MEE) (WA DoT 2024), the National Plan for Maritime Environmental Emergencies (National Plan), and the State Emergency Management Framework.

Port of Ashburton / Port of Dampier

Any marine oil pollution incident (irrespective of quantity) within either the Port of Dampier or Port of Ashburton port limits should be verbally reported immediately to Dampier or Ashburton vessel traffic services (VTS) via VHF or telephone. A POLREP is also to be submitted to WA DoT (Pilbara Ports Authority, 2023a; 2023b). A call to The Emergency Tower mobile should also be made. Pollution reporting requirements are provided in Table 7-1..

Port of Varanus Island

The Port of Varanus Island (VI) transitioned to Pilbara Ports Authority on 1 July 2021. The VI Port limits are defined in Section 4 of the Port of VI Handbook. Santos is the port operator of the Port of VI and provides the necessary services required to conduct safe operation of the facilities under Santos control. The Port of VI is governed by Pilbara Ports Authority under the WA Port Authorities Act 1999 (Pilbara Ports Authority 2021a).

Any marine oil pollution incident (irrespective of quantity) that has a risk of traversing within the Port limits should be verbally reported within 4 hours to the Harbour Master via VI Port Control. A follow up report must be made within 48 hours through the Pilbara Ports Authority Hazard and Incident Reporting Form (refer to Table 7-1). Pilbara Ports Authority also expects a POLREP to be submitted to WA DoT (refer to Appendix C) (Pilbara Ports Authority 2021a).

4.8.4 Wild Well Control

Santos maintains a contract with Wild Well Control Inc. (WWCI) for well control specialist services including relief well drilling and capping stack deployment. WWCI maintains well control response teams on standby at all times to ensure a rapid response to a well control event anywhere in the world. WWCI maintains an inventory of well control, firefighting, and specialist services equipment at its Houston headquarters and at other locations in the US and internationally.

4.8.5 The Response Group

The Response Group (TRG) is an international provider of crisis management and emergency response services including oil spill response. TRG are available to Santos 24/7 and can provide personnel for emergency response support.

5. Santos incident management arrangements

5.1 Incident management structure

The Santos Incident Management Team (IMT) (Perth) and Crisis Management Team (CMT) will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. Santos maintains internal resources (trained personnel and equipment) across its activities that provide first strike response capability and to also support an ongoing response. Should an incident occur, the IMT Duty Manager would be notified immediately. This rostered role is on-call, filled by trained Incident Commanders and available 24 hours/day and 7 days/week. The IMT Duty Manager would then activate the IMT via an automated call-out system. Documentation required in a response is accessed via the Santos Emergency Response (ER) intranet site.

As outlined in Section 3.8, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Incident Management Plan – WANATL (7700-650-PLA-0016) and the Santos Incident Management Handbook. The Incident Management Plan – WANATL and Santos Incident Management Handbook describe response planning and incident management that would operate under emergency conditions – describing how the Santos IMT operates and interfaces with the CMT and external parties.

The first priority of an escalating oil spill response to a Level 2/3 spill is the formation of an IMT and establishment of an incident coordination centre (ICC)[6]. The ongoing involvement of the IMT and CMT will be dependent on the severity and type of spill and the obligations of Santos and other agencies/authorities in the coordinated spill response.

Santos's incident response structure relevant to a Devil Creek/Reindeer incident includes:

- Devil Creek Emergency Response Team (ERT) – Onshore pipeline spills;
- Varanus Island Emergency Response Team (ERT) – Offshore spills, including Reindeer WHP;
- Santos Incident Management Team (IMT) – Perth based ICC to coordinate and execute responses to an oil spill incident;
- Santos Crisis Management Team (CMT) - to coordinate and manage threats to the company's reputation and to handle Santos's corporate requirements in conjunction with the Perth based Santos – Vice President Offshore Upstream WA;
- Other field-based command, response and monitoring teams for implementing strategies outlined within the OPEP.

The Santos incident response organisational structure is defined in the Incident Management Plan – WANATL (7700-650-PLA-0016) and the Santos Incident Management Handbook, and in Figure 5-1. The Santos IMT roles and field-based teams are scalable; roles can be activated and mobilised according to the nature and scale of the incident response.

If the incident involves a loss of well control (LOWC), the Santos Source Control Branch would also be included in the incident response structure (Figure 5-1). This team would be comprised of the following sub-teams, according to the applicable source control strategies:

- Relief well team
- Well intervention team

The Santos Source Control Branch would report directly to the Operations Section Chief and would be responsible for:

- coordinating engineering safety and operational activities;
- managing source control technical personnel from third parties (e.g. Wild Well Control);
- developing task-specific plans and procedures;
- identifying and sourcing required tools and equipment; and

[6] *The Santos ICC is located in the Santos WA Perth office.*

- approving source control components of IAPs.

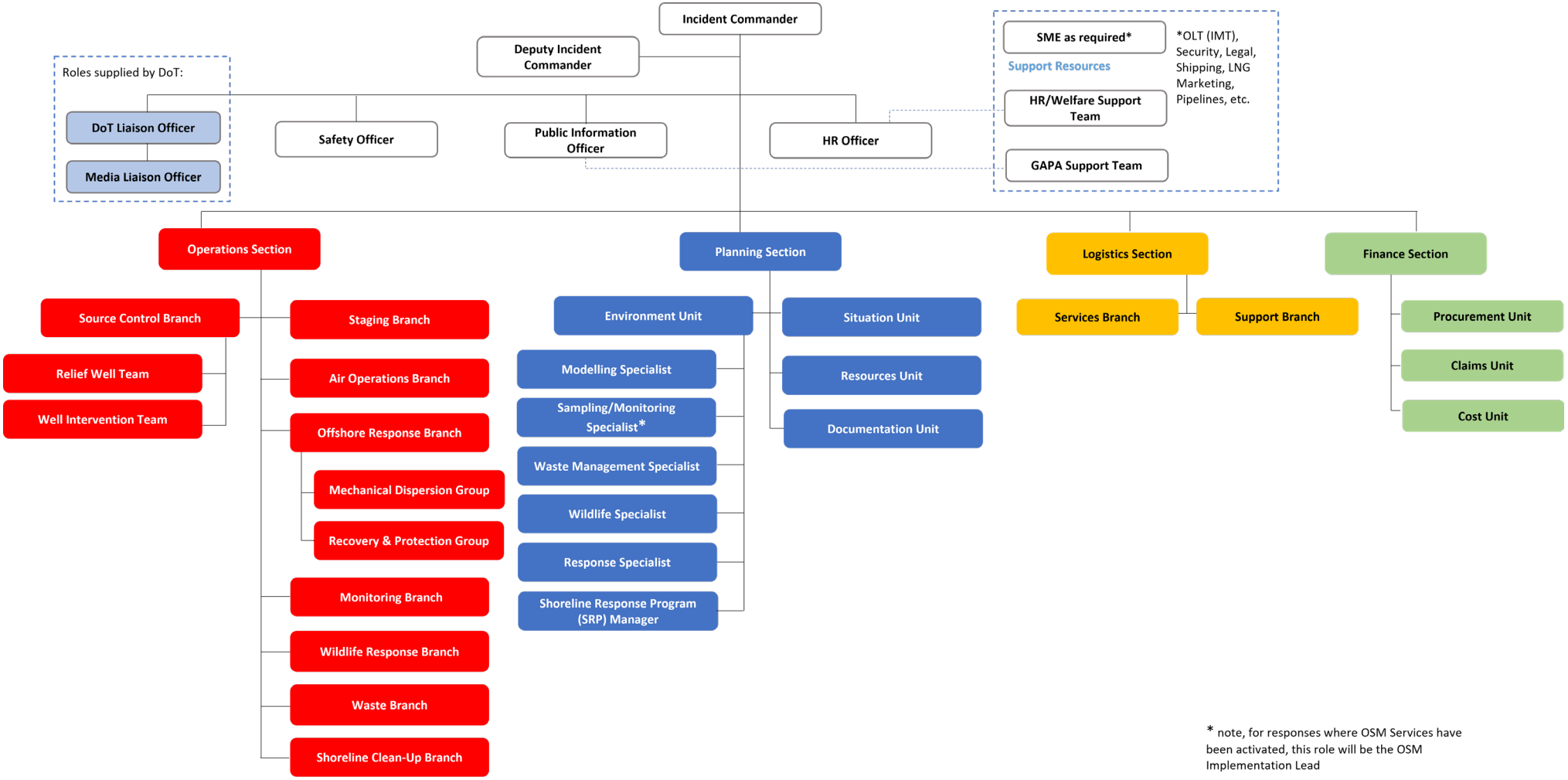

Figure 5-1: Santos incident management team organisational structure

Note: For a Level 2/3 petroleum activity spill whereby DoT is the Control Agency, either within a single jurisdiction (State water only spills) or cross-jurisdictional (spills from Commonwealth to State waters), Santos will work in coordination with DoT in providing spill response capability. Santos' expanded organisational structure for these situations is detailed in Section 4.6.

5.2 Roles and responsibilities

The following tables provide an overview of the responsibilities of the CMT and IMT:

- Santos CMT (Table 5-1)
- Santos IMT (Table 5-2)
- Field-based response team members (Table 5-3)
- DoT roles embedded within Santos CMT / IMT (Table 5-4)
- Santos roles embedded within the WA State MEECC / DoT IMT and FOBs (Table 5-5).

Not all of the roles listed are shown in Figure 5-1, as some of the roles in Table 5-2 are support roles or are specific to a particular response strategy. The IMT and field-based teams are scalable to the nature and scale of the response i.e. one person can take on multiple roles or one role can be filled by multiple people, where circumstances permit.

As per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements, where DoT is the Control Agency for spill response Santos will provide personnel to work within DoT's organisational structure. DoT will also provide a Liaison Officer / Duty Incident Commander to the Santos IMT in a coordinated response.

Table 5-1: Roles and responsibilities in the Santos Crisis Management Team (CMT)

Santos CMT Role	Main Responsibilities
Crisis Management Chair (CEO)	The CM Chair (Santos Chief Executive Officer) is responsible for the following: • Leads crisis management direction. • Provides governance and oversight of CMT operations. • Provides enterprise and strategic direction to the CMT for the resolution of the crisis event. • Delegates the CM Lead role and accountability to the appropriate ExCom designee. • Engage with the CM Lead to endorse the crisis resolution plan. • Liaise with the Santos Board and strategic stakeholders. • Provide the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Lead/ Duty Manager	The CM Lead is responsible for: • Determine the need for establishing a Level 3 response and for activating the CMT. • Determine which / if any Crisis Management Support Teams (CMST) are mobilised. • Leading the crisis resolution process. • Ensures internal and external notifications to key stakeholders. • Uses the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives. • Ensures a crisis resolution plan is developed and direct the CMT functions to implement strategies, action plans and tasks. • Determines when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.
CMT Information Management	The CMT Information Managers directly support the CMT as follows: • Support the CMT during crisis management operations. • Sets up the crisis management room, assist with set-up of communications, video conferences and information transfer within the CMT. • Advises on CMT operating processes and available resources. • Assisting with reserving break out rooms for the CMT functions and CMSTs. • Ensuring CMT crisis resolution forms are used and displayed on the monitors. • Provides incident action plan information when an IMT is established. • Monitoring and managing the welfare needs of the CMT.

Santos CMT Role	Main Responsibilities
Crisis Management Advisor	The CMT Management Advisor is responsible for the following: • Provides CMT process guidance and advice to CMT Lead, Function Leaders, and CMST. • Supports and facilitates the crisis resolution planning process. • Acts as the liaison between the CMT and IMT. • Work with CMT Information Managers to manage roster and handovers for extended CMT operations. • Schedules and facilitates post crisis debriefs and after-action reviews. The Crisis Management Advisor will support the CMT Lead as follows: • Facilitates CMT activation requirements with the CMT Lead. • Assists the CMT Lead in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts. • Advises the CMT Lead on CMT structure and requirements for CMST engagement. • Coordinates tasks delegated by CMT Lead. • Provide tools to the CMT Lead for review and crisis assessment meetings.
CMT Function Leads	CMT Function Leads include Leaders for the following areas: • Legal Counsel and Risk • Environment Health Safety and Security • Operating Unit VP • People • Government and Public Affairs (GAPA) • Media and Communications The CMT Function Leads are responsible for the following: • Participate and contribute to the crisis resolution planning process. • Each Function Leader shall determine critical communications pertaining to their area. • Mobilise and coordinate activities of the function CMST. • Advise the CMT Lead on strategic impacts, threats and mitigation created by the crisis event. • Develop and execute strategies to meet objectives endorsed by the CM Chair. • Provide support and resources via the CMST to divisional IMTs. • Ensures critical actions, decisions or points of strategic criticality are included in the CMT log. • Participates in the crisis management debrief and after-action reviews.

Table 5-2: Roles and responsibilities in the Santos Incident Management Team (IMT)

Santos Management/ IMT Role	Main Responsibilities
Vice President Offshore (VPO) Upstream WA	• Depending on the level of the incident, the VPO (and/or their delegate) will act as the primary liaison to the CMT Duty Manager. • On the activation of the IMT, the VPO is advised by the IMT Duty Manager.
Incident Commander/ Deputy Incident Commander	• Incident Commander is responsible for the overall management of the incident. Will set response objectives and strategic directions and oversee the development and implementation of Incident Action Plans
Safety Officer	• Safety Officer is responsible to develop and recommend measure for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. Safety Officer may have specialists as necessary.
Public Information Officer	• Public Information Officer is responsible for developing and releasing information about the incident to media, incident personnel and to appropriate agencies and organisations
Human Resources Officer	• Human Resource (HR) Officer is responsible for advising and assisting the Incident Commander, Command Staff and Section Chiefs on any HR related aspects of an incident.
Operations Section Chief	• The Operation Section Chief leads the Operations Section within the IMT and is responsible for the management of all tactical operations directly applicable to the primary assignments. The Operations Section Chief activates and supervises operational elements in accordance with the IAP and directs its execution.
Division Commander[7]	• Command an FOB for the coordination of resources mobilised to site. • Coordinate the field response as outlined in the Incident Action Plans for each operational period developed by the IMT. • Establish and maintain effective operation of the Forward Operating Base (FOB), Divisional Staging Area (DSA) and any secondary staging areas. • Provide advice and input into the formulation of the incident action plan for the next operational period.
Source Control Branch Director	• The Source Control Branch Director will be responsible for the implementation of the Source Control Plan (Source Control Planning and Response Guideline - DR-00-OZ-20001). The Source Control Branch Director will activate and supervise source control elements in accordance with the Incident Action Plan and direct its execution.
Relief Well Team Leader	• The Relief Well Team Leader is responsible for the management and coordination of relief well design and operations. The Relief Well Team Leader coordinates the development of the drilling plans and procedures, secures resources and manages relief well operations to ensure the relief well reaches its target. • Create groups as required to acquire relief well MODU, equipment and services and perform detailed relief well planning
Well Intervention Team Leader	• The Well Intervention Team Leader is responsible for intervention activities including initial site survey and debris clearance.
Staging Branch Director	• The Staging Branch Director is responsible for supervising the Staging Area Managers as well as coordinating their activities including assigning Staging Area Managers, receiving, maintaining, checking in/out, storing and distributing resources.
Air Operations Branch Director	• The Air Operations Branch Director is ground-based and is primarily responsible for the coordination of the air operations section (ICS 220) of the IAP and for providing logistical support to incident aircraft
Offshore Response Branch Director	• The Offshore Response Branch Director is responsible for leading the offshore response activities including protection and containment and recovery activities on water. Depending on the size and nature of the incident, various, groups, teams and task forces will be implemented including Recovery & Protection Group etc. • The Recovery & Protection Group is responsible for the deployment of containment and diversion/protection booming and managing on water recovery operations in the designated locations in compliance with the IAP.
Monitoring Branch Director	• Working closely with the Environmental Unit, the Monitoring Branch Director will be responsible for implementing the OSM plans required based on the nature and scale of the incident.

[7] *This role is only appointed when an FOB in Dampier assumes control of response operations.*

Santos Management/ IMT Role	Main Responsibilities
Oiled Wildlife Response Branch Director	• Working with relevant state authorities, the Oiled Wildlife Response Branch Director will be responsible for implementing the OWR plan for the incident including the deployment of equipment and personnel required.
Shoreline Clean-up Branch Director	• The Shoreline Clean-up Branch Director is responsible for leading all shoreline response activities working closely with the Shoreline Response Program Manager and shoreline clean-up supervisors and various locations
Waste Branch Director	• The Waste Branch Director is responsible for coordinating the on-site activities of personnel engaged in collecting, storing, transporting, and disposing of waste materials, in compliance with the IAP.
Planning Section Chief	• Planning Section Chief will lead the Planning Section within the IMT and is responsible for the collection, evaluation, dissemination and use of incident information and maintaining status of assigned resources.
Situation Unit Lead	• The Situation Unit Leader is responsible for collecting, processing, and organizing incident information relating to escalation, mitigation or intelligence activities taking place in an incident. The Situation Unit will be responsible for preparing future projections of incident growth, maps, and intelligence information.
Resources Unit Lead	• The Resource Unit Leader is responsible for maintaining the status of all assigned tactical resources and personnel at an incident. The Resource Unit will oversee the check-in of all tactical resources and personnel, maintaining a status-keeping system indicating current location and status of all the resources.
Documentation Unit Lead	• The Documentation Unit Lead us responsible for maintenance of accurate, up-to-date incident files including Incident Action Plans. Incident reports, communication logs, situation status reports etc.
Environment Unit Lead	• The Environment Unit Leader is responsible for environmental matters associated with the response, including strategic assessment, modelling, surveillance and environmental monitoring and permitting.
Technical Specialists	• Certain incidents may require the use of Technical Specialists who have specialized knowledge or expertise. Technical Specialists may function within the Planning Section or be assigned wherever their services are required. Santos will activate Technical Specialists, based on the requirements of the incident, through a range of arrangements and this may include, Modelling Specialist, Operational/Scientific Monitoring Specialist, Response Technology Specialist, Waste Management Specialist etc.
Shoreline Response Programme (SRP) Manager	• The SRP Manager reports to the Environment Unit Leader and is responsible for managing shoreline response. • Provides input to Planning and Operations Section Chiefs on shoreline response program to minimize shoreline impacts and Shoreline Clean-up Assessment Technique (SCAT) program.
SCAT Programme Coordinator	• SCAT Program Coordinator is the primary point of contact, through SRP Manager, within the IMT for all SCAT activities • SCAT Program Coordinator act as the project manager for SCAT program and will design and direct the SCAT program for any incidents • SCAT Program Coordinator will implement and manage the day-today activities for the SCAT program including establishing good management practices and safety protocols for the field teams, chairing SCAT Field Survey Team briefings and debriefings and producing daily and weekly summaries of field reports
SCAT Field Coordinator	• SCAT Field Coordinator works with SCAT Program Coordinator to develop daily missions and rolling strategy for the field teams and to provide the necessary logistics and equipment support as required
SCAT Data Manager	• SCAT Data Manager reports to the SCAT Program Coordinator and is responsible for processing field data, quality assurance, data storage and dissemination within the IMT, and for providing the SCAT Field Survey Teams with the maps and data required to conduct their missions.

Santos Management/ IMT Role	Main Responsibilities
Shoreline Treatment Recommendations (STR) Manager	• The STR Manager is responsible for the preparation of the Shoreline Treatment Recommendations (STRs) • STR Manager will work with the Environment Unit to obtain reconnaissance information to assess priority areas for initial SCAT surveys and gain approval for land access where appropriate • STR Manager ensures all approvals are obtained (e.g. concerning any endangered species, cultural, historical resources etc.) prior to undertaking shoreline activities • STR Manager will work with the Environment Unit's Technical Specialists, subject matter experts and stakeholders to ensure that their requirements and constraints are incorporated into shoreline treatment recommendations • STR Manager will work with the Operations Section to obtain advice on the feasibility, practicality and effectiveness of potential treatment strategies and tactics • STR Manager will track the progress of approved STRs to generate and update progress reports
Logistics Section Chief	• Logistics Section Chief is responsible for providing facilities, services and materials in support of the incident. The Logistics Section Chief participates in the development and implementation of the Logistics Section of the IAP.
Services Branch Director	• Service Branch Director, when activated is under the supervision of the Logistics Section Chief and is responsible for the management of all service activities for the incident including the operations of the Communications, Medical and Food Units
Support Branch Director	• Support Branch Director, when activated, is under the supervision of Logistics Section Chief and is responsible for the development and implementation of logistics plan in support of the IAP. The Support Branch supervises the operations of the Supply, Facilities, Ground Support and Vessel Support Units.
Finance Section Chief	• Finance Section Chief is responsible for all the financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance Section
Procurement Unit Lead	• Procurement Unit Leader us responsible for administering all financial matters pertaining to vendor contracts and leases. The Procurement Unit Leader will execute all procurements in accordance with the policies and procedures of Santos
Claims Unit Lead	• The Claims Unit Leader is responsible for the management and direction of all administrative matters pertaining to compensation and claims related matters for any incident
Cost Unit Lead	• The Cost Unit Leader is responsible for collecting all cost data and providing cost estimated and any cost saving recommendations for the incident

Table 5-3: Roles and responsibilities in the field-based response team (ERT)

Field-Based Position	Main Responsibilities
Emergency Commander (Facility OIM)	• Assess facility-based situations/ incident and respond accordingly. • Single point of communications between the ERT and IMT. • Directs emergency response activities in accordance with the Santos ER principles and philosophy • Communicates the incident response actions and delegates actions to the Incident Commander. • Manage the spill incident in accordance with Facility Emergency Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan (this document) • Coordinates medical evacuations as required. • Liaises with the Perth IMT Operations Section Chief if/when the IMT is established *Refer to the facility Emergency Response Plan for further description of roles and responsibilities*
Emergency Coordinator	• Establishes and maintains contact with the incident scene • Ensures information is passed to and from the On-Scene Commander, including relevant emergency information from the Command Team time-outs (e.g. source of the spill, if the spill is ongoing or contained, number of personnel responding); also advises On-Scene Commander when the next Command Team time-out will be • Ensures accurate transfer of information from On-Scene Commander to Status Board log person • Communicates with outside assistance (e.g. vessels, aircraft) • If instructed, coordinates activities such as spill control/response strategies • If instructed, liaises with onshore technical authorities and onshore IMT • Informs Emergency Commander of incident and vessel status. *Refer to the facility Emergency Response Plan for further description of roles and responsibilities*
On-Scene Commander (OSC) (ERT Field Team Leader) [8]	• Undertakes command and leads field response as directed by the Emergency Coordinator, where safe to do so. • Establishes, when appropriate, a Forward Control Point. • Maintains spill responder safety in accordance with the Santos response philosophy. • Assures all field and affected area personnel are accounted for. • Deploys and implements spill control/response strategy resources to contain and control the spill incident, as per advice from the Emergency Coordinator / Incident Commander / Division Commander. *Refer to the facility Emergency Response Plan for detailed descriptions of roles and responsibilities*
Medical Evacuation Team	• Manages all medical and transportation requirements related to injured personnel to an appropriate medical facility. *Refer to the Medical Evacuation Procedure (SO-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team*
Source Control Branch	• Responds to incidents involving well loss of containment to stop the flow of oil to sea *Refer to the Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Branch*
Wildlife Response Branch	• Responds to oiled wildlife incidents to minimise the impacts to wildlife *Refer to the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for a description of the wildlife response branch and the Santos Incident Management Handbook for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Branch*
Monitoring Branch	• Monitors the effectiveness of response strategies • Monitors impacts to sensitive receptors (and their recovery) from an oil spill and associated response actions *Refer to the North West Shelf OSM-BIP (7715-650-ERP-0002) for detail on Operational and Scientific Monitoring Team roles and responsibilities.*

[8] *The On-scene Commander (OSC) is either the Santos Company Site Representative (if present) or Vessel Master for vessel-based incidents; or the OIM if the spill is related to the MODU. The OSC will be determined during the initial activation stages of the activity.*

Table 5-4: Department of Transport Roles Embedded within Santos's CMT/IMT

DoT roles embedded within Santos' CMT/IMT	Main Responsibilities
DoT Liaison Officer (prior to DoT assuming role of Control agency) Deputy Incident Controller – State Waters (after DoT assumes role of Control agency)	• Provide a direct liaison between the Santos IMT and the State MEECC. • Facilitate effective communications between DoT's State Marine Pollution Coordinator (SMPC) the Incident Controller and Santos' appointed CMT Lead/Incident Commander. • Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters. • Assist in the provision of support from DoT to Santos. • Facilitate the provision of technical advice from DoT to Santos' Incident Commander as required.
Media Liaison Officer	• Provide a direct liaison between the Santos Media team and DoT IMT Media team. • Facilitate effective communications and coordination between the Santos and DoT media teams. • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information & Warnings team. • Offer advice to the Santos Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures.

Table 5-5: Santos Personnel Roles Embedded within the State Maritime Environmental Emergency Coordination Centre (MEECC)/ Department of Transport (DOT) IMT/ Forward Operations Base

Santos roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
CMT Liaison Officer[9]	• Provide a direct liaison between the Santos CMT and the State MEECC. • Facilitate effective communications and coordination between the Santos CMT Lead and the SMPC. • Offer advice to SMPC on matters pertaining to Santos crisis management policies and procedures
Deputy Incident Controller	• Provide a direct liaison between the DoT IMT and the Santos IMT. • Facilitate effective communications and coordination between the Santos Incident Commander and the DoT Incident Controller. • Offer advice to the DoT Incident Controller on matters pertaining to the Santos incident response policies and procedures. • Offer advice to the Safety Coordinator on matters pertaining to Santos safety policies and procedures particularly as they relate to Santos employees or contractors operating under the control of the DoT IMT.
Deputy Intelligence Officer	• As part of the DoT Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness. • Facilitate the provision of relevant modelling and predications from the Santos IMT. • Assist in the interpretation of modelling and predictions originating from the Santos IMT. • Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the Santos IMT. • Facilitate the provision of relevant mapping from the Santos IMT. • Assist in the interpretation of mapping originating from the Santos IMT. • Facilitate the provision of relevant mapping originating from the Santos IMT.
Deputy Planning Officer	• As part of the DoT Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub-plans • Facilitate the provision of relevant IAP and sub-plans from the Santos IMT.

[9] *The role described as the Santos Offshore Liaison Officer in Figure 4-1.*

Santos roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
	• Assist in the interpretation of the Santos OPEP from Santos. • Assist in the interpretation of the Santos IAP and sub-plans from the Santos IMT. • Facilitate the provision of relevant IAP and sub-plans originating from the DoT IMT to the Santos IMT. • Assist in the interpretation of Santos' existing resource plans. • Facilitate the provision of relevant components of the resource sub-plan originating from the DoT IMT to the Santos IMT. • (Note this individual must have intimate knowledge of the relevant Santos OPEP and planning processes).
Environment Support Officer	• As part of the Intelligence Team, assist the Environment Coordinator in the performance of their duties in relation to the provision of environmental support into the planning process • Assist in the interpretation of the Santos OPEP and relevant Tactical Response Plan (TRPs). • Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos IMT. • Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos IMT.
Deputy Public Information Officer[10]	• As part of the Public Information Team, provide a direct liaison between the Santos Media team and DoT IMT Media team. • Facilitate effective communications and coordination between Santos and DoT media teams[11]. • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information & Warnings team. • Offer advice to the DoT Media Coordinator on matters pertaining to Santos media policies and procedures. • Facilitate effective communications and coordination between Santos and DoT Community Liaison teams. • Assist in the conduct of joint community briefings and events. • Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos community liaison policies and procedures. • Facilitate the effective transfer of relevant information obtained from the Contact Centre to the Santos IMT.
Deputy Logistics Officer	• As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort. • Facilitate the acquisition of appropriate supplies through Santos' existing OSRL, AMOSC and private contract arrangements. • Collects Request Forms from DoT to action via the Santos IMT. • (Note this individual must have intimate knowledge of the relevant Santos logistics processes and contracts).
Deputy Waste Management Coordinator	• As part of the Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters. • Facilitate the acquisition of appropriate services and supplies through Santos' existing private contract arrangements related to waste management; and Collects Waste Collection Request Forms from DoT to action via the Santos IMT.

[10] In the event of an incident, Santos can provide the DoT IMT with a list of agencies, organisations, representative bodies, and other stakeholders that were consulted in the development of the Environment Plan to assist DoT with the management and provision of public information.

[11] In the event DoT assumes the role of Control Agency in State Waters, Santos acknowledges that the DoT IMT will be the lead IMT for public information and warnings and community liaison. In such circumstances, Santos retains the right to manage its own media interests, but acknowledges the strong preference for DoT and Santos to issue joint media statements and conduct joint media conferences and the importance of close liaison between the respective Media Teams.

Santos roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
Deputy Finance Officer	• As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Santos' existing OSRL, AMOSC and private contract arrangements. • Facilitate the communication of financial monitoring information to Santos to allow them to track the overall cost of the response. • Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to Santos.
Deputy Operations Officer	• As part of the Operations Team, assist the Operations Officer in the performance of their duties in relation to the implementation and management of operational activities undertaken to resolve an incident. • Facilitate effective communications and coordination between the Santos Operations Section and the DoT Operations Section. • Offer advice to the DoT Operations Officer on matters pertaining to Santos incident response procedures and requirements. • Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of Santos and DoT response efforts.
Deputy Division Commander (FOB)	• As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between Santos' Forward Operations Base/s (FOB/s) and the DoT FOB. • Facilitate effective communications and coordination between Santos FOB Operations Commander and the DoT FOB Operations Commander. • Offer advice to the DoT FOB Operations Commander on matters pertaining to Santos incident response policies and procedures. • Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to Santos employees or contractors. • Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to Santos safety policies and procedures.

5.3 Cost Recovery

Santos has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its petroleum activities, including major oil spills. This includes costs incurred by relevant Control Agencies (e.g. DoT) and third-party spill response service providers.

5.4 Training and Exercises

In order to refresh IMT roles and responsibilities and provide familiarisation with OPEP processes and arrangements, IMT workshops are conducted as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

To familiarise the IMT with functions and processes, an OPEP Desktop and Activation Exercise is undertaken as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Exercise planning takes into consideration virtual/remote access requirements and government mandate border restrictions (e.g. Covid-19).

All workshops and exercises undertaken are recorded in the Santos EHS Toolbox, with the key recommendations recorded and tracked.

5.4.1 Incident management team training and exercises

Santos provides training to its personnel to fill all required IMT positions.

Competency is maintained through participation in regular response exercises and workshops. Exercise and training requirements for Santos' IMT members are summarised in Table 5-6.

Table 5-6: Training and exercise requirements for incident management team positions

IMT Role	Exercise	Training
Incident Commander	One Level 3 exercise annually or two Level 2 exercises annually[12]	• PMAOMIR418 Co-ordinate Incident Response • AMOSC – IMO3 equiv. Oil Spill Response Command & Control
Operations Section Chief/ Source Control Branch Director		• PMAOMIR322 Manage Incident Response Information • AMOSC – IMO3 equiv. Oil Spill Response Command & Control
Planning Section Chief Logistics Section Chief Environment Unit Leader		• PMAOMIR322 Manage Incident Response Information • AMOSC – IMO2 equiv. Oil Spill Response Management
Safety Officer Supply Unit Leader Geographic Information System (GIS) Team Leader Data Manager[13] HR Officer Situation Unit Leader Documentation Unit Leader IMT Log and Situation Unit Leader		• PMAOMIR322 Manage Incident Response Information • AMOSC – Oil Spill Response Familiarisation Training
Relief Well Team Leader Well Intervention Team Leader		• Drilling Well Control accredited training through International Well Control Forum (IWCF) • Level 4 (Well Site Supervisor Training)

5.4.2 Oil spill responder training

Santos has an internal capability of trained oil spill responders that can be deployed into the field in a spill response and has access to external trained spill responder resources (Table 5-7).

Table 5-7: Spill responder personnel resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group Responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 equiv. Oil Spill Response Operations	16
Santos Facility Emergency Response Teams	Present at Devil Creek, Varanus Island Facilities for first strike response to incidents	Internal Santos training and exercises as defined in each facility's Emergency Response Plan Emergency Commander to have AMOSC – Oil Spill Response Familiarisation Training.	One Incident Response (IR) team per operational facility per shift.

[12] *All IMT members are required to participate in at least one Level 3 exercise every two years*

[13] *Data Manager is an administrative support role, not an IMT role, but is included here for completeness*

Responder	Role	Training	Available Number
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken triennially).	7
Santos Oil Spill Response Team	Provides a pool of Santos employees trained to perform leadership roles in an IMT or in the field during an oil spill response.	As per the Santos OSR training matrix	140
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every two years). AMOSC – IMO1 equiv. Oil Spill Response Operations and/or IMO2 equiv. Oil Spill Response Management	As defined in Core Group Member Reports[14] Target of 115 members (minimum 84, maximum 140). Refer to AMOSC Core Group Program and Policies V2.0 (AMOSC, 2024)
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos-OSRL contract.	As per OSRL training and competency matrix	18 responders guaranteed 80 dedicated responders available, may be approved under best endeavours
AMOSC Staff	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix	16[15]
Santos Source Control Personnel	Management and coordination of source control strategies including relief well drilling and subsea intervention	Internal Santos training and exercises. IWCF Level 4 certification	60[16]
Oiled Wildlife Response Roles	Refer Section 15		
OSM Services Provider	Refer to Section 16 and Santos North West Shelf OSM-BIP (7715-650-ERP-0002) Section 9.1		
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided.	Nominally over 1,000.
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

[14] A total of 115 personnel as of February 2025 (AMOSC Member's website).

[15] AMOSC has a permanent staff of 16 available on a 24/7 basis (AMOSC Plan, 2021),12 of which are available for field response, and 4 for administrative/management support roles.

[16] Made up of D&C staff that are members of the Santos OSR Team, and other D&C staff.

In addition to Table 5-7, these resources are available for spill response and may be activated by the relevant Control Agency:

- National Plan: National Response Team (NRT) – Trained oil spill response specialists including aerial observers, containment and recovery crews and shoreline clean-up personnel deployed under the direction of AMSA and the IMT in a response. The NRT is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2024)
- WA SHP-MEE: State Response Team (SRT) – Oil pollution response team available to assist under the jurisdiction of the DoT in State waters. SRT members remain trained and accredited in line with the SHP-MEE requirements (WA DoT 2024).

In the event of a spill, the trained spill responders outlined in Table 5-7 would be required to undertake various roles in key spill response operations, including monitor and evaluate, shoreline protection, shoreline clean-up and OWR.

In the event of a spill, Team Leader roles for protection and deflection and for shoreline clean-up would be filled through Santos AMOSC Core Group Responders and then industry Core Group Responders.

5.5 Response testing arrangements and audits

Santos has oil spill response testing arrangements in place in accordance with the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001) which provides a process for continually monitoring of OSRO capability. This also includes regular oil spill response equipment inventory checks from the various sources. Testing of key response provider arrangements may be done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider are assessed against the performance requirement.

5.5.1 Testing arrangements

Not all spill preparedness and response arrangements will be tested simultaneously. The frequency of testing will relate to the potential spill level, spill risk and complexity of response.

Santos uses a range of tests to ensure that the various response arrangements function as required, including:

- contract/plan review
- audit
- notification/communication check
- deployment exercise
- desktop exercise
- Level 2/3 IMT Exercise

These tests and the testing schedule are detailed in full in the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001); an excerpt of the testing arrangements plan is shown in Figure 5-2. Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified Key Performance Indicators (KPIs).

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
2.	Monitor and Evaluate				
	Monitor and Evaluate - Vessel Surveillance a) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
	Monitor and Evaluate - Aerial Surveillance a) Access to aircrafts	Review – Contract / Agreement	Annually	To confirm access to aircrafts for surveillance	Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance
	Monitor and Evaluate - Aerial Surveillance b) Access to trained aerial observers	Review – Contract / Agreement	Annually	To confirm access to trained aerial observers	Review to confirm access to trained aerial observers through; • Trained Santos personnel or • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Unmanned Aerial Vehicles (UAV) a) Access to UAV providers	Review – Contract / Agreement	Annually	To confirm access to UAV providers	Review to confirm access to UAV providers through; • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Fauna observations a) Maintain a list of air charter companies that could provide fauna observation services	Review – List of air charter companies for fauna observations	Annually	To confirm that a list of air charter companies that could provide fauna observation services is maintained	Review to confirm that a list of air charter companies that could provide fauna observation services is maintained
	Monitor and Evaluate – Tracking Buoys a) Access to Tracking Buoys	Review – Contract / Agreement	Prior to activity commencement	To confirm access to tracking buoys	Review to confirm access to Santos owned Tracking Buoys
	Monitor and Evaluate - Tracking Buoys b) Response readiness	Communication/Tracking software Test	6-monthly	To confirm response readiness for Tracking buoys	Tracking Buoys pass functional test as per operational instructions
	Monitor and Evaluate - Oil Spill Modelling a) Access to oil spill modelling service provider	Review – Contract / Agreement	Annually	To confirm access to emergency response oil spill modelling services	Review to confirm access to emergency oil spill modelling services through maintenance of service provision contract

Figure 5-2: Excerpt of testing arrangements plan

Source: Taken from Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001)

All testing activities are documented, and all reports generated will be saved in Santos's EHS Toolbox system. Once completed, records of testing arrangements are entered into the Santos EHS Toolbox and any actions, recommendations or corrective actions identified are assigned a responsible party for completion and tracked to closure. The status of completion is tracked through the 'Action module' in the EHS Toolbox and communicated widely through monthly EHS KPI reporting.

Source control testing arrangements have been formulated with reference to industry guidelines including the Australian Petroleum Production & Exploration Association (APPEA) Offshore Titleholders Source Control Guideline (June 2021) and the NOPSEMA Information Paper: Source Control Planning and Procedures IP1979 (June 2021).

Source control objectives and KPIs are developed in order to test the response arrangements specified in this OPEP and the Source Control Planning and Response Guideline (DR-00-OZ-20001). In addition to objectives and KPIs, test frequency and type of test are also detailed in the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001).

For each source control exercise, a copy of the exercise materials is recorded in the EHS toolbox. Action items identified are tracked in EHS toolbox to completion. Lessons learnt are incorporated into Santos guidelines and procedures as part of a process of continual improvement.

5.5.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per Santos' annual Assurance Schedule. Audits help identify and address any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and corrective actions (non-conformances) will be formally noted and discussed, with corrective actions developed and accepted. In some cases, audits may conclude with potential amendments to the OSCP.

Multiple oil spill response organisations are engaged by Santos. These organisations are responsible for auditing and maintaining their own capacity. The Santos Emergency Response Coordinator (Oil Spill) oversees the audit and maintenance programs of its service providers through regular reporting requirements and any third-party assurance activities, including:

- The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong, Fremantle, Exmouth and Broome is audited every two years under the direction of AMOSC's participating members. The intent is to assure to Santos and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in OSCPs and AMOSC's Service Level Statement.
- The deployment readiness and capability of OSRL's oil spill response equipment and personnel is audited every two years by the Oil Spill Response Coordinator. The intent is to assure Santos of OSRL's ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos' OSCPs and OSRL's SLA.

6. Response strategy selection

6.1 Spill scenarios

Environmental impacts and risk assessments for the operational activities of the Devil Creek pipeline (offshore and onshore) and the Reindeer WHP have been undertaken in the Devil Creek Gas Supply and Sales Gas Pipeline Operations Environment Plan (Devil Creek EP; 7715-650-EMP-0022-01) and the Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; 7715-650-EMP-0023), respectively.

The worst case credible scenarios for the activity are presented for Commonwealth and State waters (Table 6-1 and Table 6-2) and for onshore releases (Table 6-3). All other spill scenarios are of a lesser scale and extent. By demonstrating capability to manage the response to the worst-case scenarios, Santos assumes other scenarios that are smaller in nature and scale can also be managed by the same capability. Response performance measures have been defined based on a response to these worst-case scenarios.

The worst-case credible spill scenarios selected to inform this OPEP are presented below. The Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan WA-41-L and WA-18-PL (Reindeer EP;7715-650-EMP-0023) and Devil Creek Gas Supply and Sales Gas Pipeline Operations Environment Plan (onshore & State waters) (Devil Creek EP; 7715-650-EMP-0022-01) (Section 7.5.2 & Section 7.6.2 respectively) detail the derivation of these maximum credible spills.

Appendix A describes the characteristics and behaviour associated with hydrocarbons that may unintentionally be released.

Table 6-1: Maximum credible spill scenarios for Commonwealth Waters

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)
Scenario 1: Complete loss of well control at surface at the Reindeer WHP (100% full bore flow rate release).	Reindeer condensate	4,029 m^3 over 70 days
Scenario 2: Condensate spill from a subsea pipeline leak near the Commonwealth/State Boundary (CSB)	Reindeer condensate	121.4 m^3 over 3.71 hours
Scenario 4: Surface release of marine diesel oil (MDO) following a vessel collision at the WHP	Marine Diesel Oil (MDO)	325 m^3 over 1 hour
Scenario 5: Surface release of marine diesel oil (MDO) following a vessel collision at the CSB	MDO	325 m^3 over 1 hour

Table 6-2: Maximum credible spill scenarios for State Waters

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)
Scenario 3: Condensate spill from a subsea pipeline leak near the horizontal directional drilling (HDD) break through location (the shoreline crossing)	Reindeer condensate	121.4 m^3 over 3.75 hours
Scenario 6: Surface release of MDO following a vessel collision at the HDD crossing	MDO	325 m^3 over a 1-hour period

Table 6-3: Maximum credible onshore spill scenario

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)
Land-based spill – release from supply gas onshore pipeline due to a major rupture [17]	Reindeer condensate	121.4 m^3 over a 0–24 hour period

[17] *A rupture of the onshore buried pipeline is of low credibility due to its buried position. A slow leak is a more likely release mechanism. The worst-case credible spill is a release of 121.4 m^3 of Reindeer condensate. This represents the entire pipeline inventory and is considered a conservative volume given the significant length of pipeline grading away from the buried shoreline section to the WHP.*

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in Section 7.1.4 of the EP. In addition to the environmental impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These thresholds are provided as a guide for response planning based on case studies that have demonstrated some response strategies require certain oil spill thicknesses and conditions to be effective. These are shown in Table 6-4.

Table 6-4: Hydrocarbon thresholds for response planning

Floating Hydrocarbon concentration (g/m²)	Description
≥1	Used (in part) for operational and scientific monitoring planning, as described in the North West Shelf OSM-BIP (7715-650-ERP-0002) Section 2.1
≥50	Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
≥100	Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application Estimated minimum shoreline accumulation threshold for shoreline clean-up

6.3 Spill modelling results (State and Commonwealth waters)

The Commonwealth EP (7715-650-EMP-0023) and State EP (7715-650-EMP-0022-01) provide information on the Environment that may be affected (EMBA) for worst case hydrocarbon spills as well as the hydrocarbon impact assessments. This considers modelling results for subsea oil (i.e. entrained oil and dissolved aromatic hydrocarbons) as well as floating/shoreline accumulated oil. While spill response operations outlined in this OPEP would focus on Priority Protection Areas, the Scientific Monitoring Planning Area is relevant for informing the area in which oil spill scientific monitoring could be required (refer to Section 16 and Appendix N).

6.3.1 Stochastic modelling results

The selected worst-case spill scenarios were modelled for Reindeer and DC activities using a stochastic approach.

A total of 100 spill trajectories were simulated for each season (i.e. 300 in total) using a number of unique environmental conditions sampled from historical metocean data.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed through the use of spill response strategies) for the allocation and mobilisation of spill response resources. Therefore, these are the results presented in this OPEP for primary consideration.

The receptors predicted to receive floating oil or shoreline loading above the response planning thresholds outlined in Table 6-4 for pipeline leak and vessel collision scenarios are presented in Table 6-5, Table 6-6 and Table 6-7. For each scenario the shoreline loading results represent the worst simulation results from all stochastic modelling runs across all seasons. Note that there was no predicted floating or shoreline concentrations above response planning thresholds for scenario 1 (LOWC) and scenario 2 (pipeline leak from CSB)..

Modelling results for dissolved and entrained oil for the worst-case scenarios have not been included in this OPEP given there are limited response strategies that will reduce subsurface impacts. However, Santos will use these results in the assessment of locations requiring a baseline data review for scientific monitoring (Appendix N).

Refer to Section 7.6 of the State EP (7715-650-EMP-0022-01) for dissolved and entrained thresholds and Section 7.7 and Section 7.8 for potential impacts to receptors from the pipeline rupture and vessel collision spill scenarios respectively. Refer to Section 7.5 of the Commonwealth EP (7715-650-EMP-0023) for dissolved and entrained thresholds and Section 7.6 to Section 7.8 for potential impacts to receptors from the LOWC, pipeline rupture and vessel collision spill scenarios.

Table 6-5: Summary of oil exposure above response planning thresholds for a subsea pipeline leak of Reindeer condensate near the HDD crossing (Scenario 3)

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
Northern Islands Coast	No exposure modelling results were provided for the Northern Islands Coast Environmental Value Area (EVA) as the release location is within the receptor.	N/A	28.33	2	11	3	8	3

NC = No Contact

Source: RPS (2024)

Table 6-6: Summary of oil exposure above response planning thresholds for a MDO spill resulting from a vessel collision at the WHP (Scenario 4)

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
Muiron Islands	No EVAs were predicted to be exposed to floating oil	N/A	2	249 (10 days, 9 hours)	NC	N/A	2	NC
Montebello Islands	No EVAs were predicted to be	N/A	1	95 (3 days, 23 hours)	NC	N/A	<1	NC

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
	exposed to floating oil							
Ningaloo Coast North	No EVAs were predicted to be exposed to floating oil	N/A	0.33	376 (15 days, 16 hours)	NC	N/A	<1	NC
Southern Island Coast	No EVAs were predicted to be exposed to floating oil	N/A	1	260 (10 days, 20 hours)	NC	N/A	<1	NC

NC = No Contact, N/A= Not applicable

Source: RPS (2024)

Table 6-7: Summary of oil exposure above response planning thresholds for a MDO spill resulting from a vessel collision at the CSB (Scenario 5)

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
Dampier Archipelago	0.67	48 (2 days)	1.67	56 (2 days, 8 hours)	0.67	58 (2 days,10 hours)	24	5
Barrow Island	NC	N/A	4.33	133 (5 days, 13 hours)	0.33	343 (14 days, 7 hours)	5	1
Lowendal Islands	NC	N/A	6	105 (4 days, 9 hours)	1.33	133	8	2

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
						(5 days, 13 hours)		
Montebello Islands	NC	N/A	9.33	93 (3 days, 21 hours)	1.33	139 (5 days, 19 hours)	8	3

NC = No Contact, N/A= Not applicable

Source: RPS (2024)

Table 6-8: Summary of oil exposure above response planning thresholds for a MDO spill resulting from a vessel collision at the HDD Crossing (Scenario 6)

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
Dampier Archipelago	No EVAs were predicted to be exposed to floating oil	N/A	25	52 (2 days, 4 hours)	5.33	115 (4 days, 19 hours)	9	3
Middle Islands Coast	No EVAs were predicted to be exposed to floating oil	N/A	0.33	275 (11 days, 11 hours)	NC	NC	<1	NC
Northern Islands Coast	Floating oil and water column exposure modelling results for the Northern	N/A	47.67	2	28	2	199	11

Receptor contact	Probability (%) of floating oil at concentrations ≥1 g/m²	Min. time for floating oil at concentrations ≥1 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²	Min. time for shoreline accumulation at concentrations ≥10 g/m² (hours)	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² (hours)	Max. accumulated volume (m³) along this shoreline with concentrations ≥100 g/m² for the worst simulation	Max. length of oiled shoreline (km) at concentrations ≥100 g/m² for the worst simulation
	Islands Coast EVA were not provided as the release location is within the receptor.							

NC = No Contact, N/A= Not applicable

Source: RPS (2024)

6.4 Evaluation of applicable response strategies

Based on the nature and scale of the credible spill scenarios outlined in Section 6.1 and spill modelling results (Section 6.3) the following spill response strategies have been assessed as potentially applicable for combatting an oil spill (Table 6-9).

Note: The information contained in Table 6-9 has been developed by Santos for preparedness purposes. Santos may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering State waters, DoT will ultimately determine the strategies and controls implemented for most State water activities with Santos providing resources and planning assistance.

Table 6-9: Evaluation of applicable response strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
Source Control	Spill kits	✓ 1	✓ 1	Relevant for containing spills that may arise on board a vessel or WHP.
	Secondary containment	✓ 1	✓ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or WHP. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable open deck drainage will be closed to prevent hydrocarbon draining into the marine environment.
	Shipboard Oil Pollution Emergency Plan (SOPEP)	✓ 1	✗	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing cargo via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilt.
	Pipeline isolation (ESD)	✗	✓ 1	Triggered automatically or manually as per Devil Creek Emergency Response Plan (DC-40-IF-00096)
	Well Emergency Shutdown (ESD)	✗	✓ 1	
	Surface well kill	✗	✓ 1	Considered during relief well planning but may not be possible depending upon technical and safety constraints. Surface well kill is only considered when the estimated leak rate is small enough not to generate an explosive gas cloud and access to the platform is still preserved. This methodology would not be considered should safe access to the platform or ability to operate a vessel alongside the platform not be achievable.
	Capping Stack	✗	✗	Not applicable for production platform wells (not compatible with Capping Stack).
	Relief well drilling	✗	✓ 1	Relevant for loss of well control. Relief well drilling is the primary method for killing the well. To be conducted as per the Source Control Planning and Response Guideline (DR-00-OZ-20001) and well-specific Source Control Plan (SCP)
In-Situ Burning	Controlled burning of oil spill	✗	✗	Not applicable to gas wells due to safety hazards. The condensate is predicted to be very volatile with naturally high rates of evaporation. Not applicable to MDO spills due to inability to contain MDO making it very difficult to maintain necessary slick thickness for ignition and sustained burning. In addition, in-situ

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
				burning is not normally considered as an acceptable response strategy due to the atmospheric emissions created.
Monitor and Evaluate Plan	Vessel surveillance	✓ 1	✓ 1	• Provides real-time information on spill trajectory and behaviour (e.g. weathering). • Informs implementation of other response strategies. • Vessel personnel may not be trained observers. • Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure implementation. • Constrained to daylight. • Limited to visual range from the vessel. • Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance			• Provides real-time information on spill trajectory and behaviour (e.g. weathering). • May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). • Informs implementation of other response strategies.
	Tracking buoys			• Can be implemented rapidly. • Can provide indication of near-surface entrained / dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory Modelling			• Can be implemented rapidly. • Predictive - provides estimate of where the oil may go, which can be used to prepare and implement other responses. • No additional field personnel required. • Not constrained by weather conditions. • Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. • May not be 100% accurate. • Requires in-field calibration.
	Satellite Imagery			• Can work under large range of weather conditions (e.g. night-time, cloud cover etc) • Mobilisation restricted to image availability • Requires processing • May return false positives

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
Chemical dispersion	Vessel Application	✗	✗	**MDO** MDO does not contain persistent hydrocarbons and has high natural spreading, dispersion and evaporation rates in the marine environment. Dispersant use is not advised on light distillate fuels such as MDO as these oils will evaporate and naturally disperse quite rapidly under most conditions (IPIECA-IOGP 2016a). Therefore, considering the rapid evaporation rates of MDO and the tendency to naturally disperse, the addition of chemical dispersants would have little to no net environmental benefit whilst potentially increasing localised toxicity in the water column. **Reindeer Condensate** Reindeer condensate is not considered a persistent hydrocarbon and has a very high natural evaporation and dispersion rates in the marine environment, rapidly reducing the volume of hydrocarbons remaining at the sea surface. Spill modelling indicates that these natural weathering processes will prevent floating condensate from impacting shorelines at all but extremely low volumes. Given the gas release and relative shallow depth of the Reindeer platform, applying subsea dispersant through an SFRT is not considered feasible due to access and safety constraints. Also, subsea dispersant injection would not be very efficient and would not mitigate the high levels of VOCs at the sea surface from the released condensate due to the shallow water depth. The use of subsea dispersants may also increase dissolved organics that would have otherwise evaporated at the sea surface. On the basis of the above, chemical dispersant application is not recommended as an applicable strategy for the credible spill scenarios covered under this OPEP.
	Aerial Application	✗	✗	
	Subsea Application	✗	✗	
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	✗	✗	Containment and recovery is not suitable for highly volatile oils given their rapid weathering nature and strong tendency to entrain into the upper water column in the presence of moderate winds (i.e. >12 knots). On water containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney and Caplis 2017; NOAA 2013). McKinney and Caplis (2017) tested the effectiveness of various oil skimmers at different oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was <50 g/m^2. **MDO** Containment and recovery is not suitable for MDO given its rapid weathering nature and strong tendency to entrain into the upper water column in the presence of moderate winds (i.e. >10 knots). MDO will evaporate and spread quickly to a thin film, making recovery via skimmers difficult and ineffective. **Reindeer Condensate** Given the high level of VOCs and rapid weathering nature of Reindeer condensate, this response is not considered to be effective in reducing impacts. The ability to contain and

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
				recover spreading condensate on the ocean water surface is extremely limited due the very low viscosity, high level of VOCs, and very low residuals of this hydrocarbon.
Mechanical Dispersion	Vessel prop-washing	✓ 2	✓ 2	• Safety is a key factor and slicks with potential for high Volatile Organic Compound (VOC) emission are not suitable. • Recommended for the removal of sheens. • Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of mechanical dispersion is to reduce the concentration of floating oil which could potentially coat receptors at the sea surface (e.g. sea birds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. • MDO and Reindeer condensate are very light oils that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. • Given the condensate is predicted to have a high rate of natural volatility and a spill would originate in offshore waters, mechanical dispersion of fresh condensate would not be recommended – this will allow the evaporation process to occur more readily. Dispersing weathered condensate away from the spill site (that has lost lighter products) may be beneficial if there was a potential for this hydrocarbon to impact on receptors at the sea surface or along shorelines. • Mechanical dispersion will be considered at the discretion of the On-Scene Commander/IMT or by the relevant Control Agency.
Protection and Deflection	Booming in nearshore waters and at shorelines	✓ 2	✓ 2	Protection and deflection will be considered if monitor and evaluate activities show or predict contact sensitive shorelines. Note that shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. **MDO (Scenario 4, 5 & 6)** Modelling of a vessel collision at the WHP indicated very low probability and accumulation of oil on shorelines associated with this scenario. • The vessel collision scenario at the CSB indicated potential for shoreline impact to Montebello Islands and Lowendal Islands (9% and 6% respectively) and minimum time to receptors of over 90+ hours. For the vessel collision at the HDD crossing the Northern Islands Coast was predicted to have a 47% probability of being impacted by ≥10g/m^2 shoreline oil within 2 hours. Given the high rates of natural dispersion and the high rate of biodegradation of MDO, it would be better to focus on the priority areas for protection.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
				• Modelling predicts low probabilities (<5%) for shoreline accumulation ≥100 g/m^2 for most scenarios (Scenario 4 = no contact predicted; Scenario 5 = ≤1.33%), with the exception of Northern Islands Coast (scenario 3 = 11% and scenario 6 = 28%). • In certain conditions or situations, shoreline protection and deflection may be a suitable strategy to prevent shoreline contact and is therefore considered a secondary response strategy for MDO. This strategy is considered to be a secondary response strategy for MDO where it is safe and practical to implement and where priority protection areas are at risk of impact from MDO. **Reindeer condensate (Scenario 1 ,2 & 3)** Modelling predicts low probabilities of contact with shorelines and minimal shoreline accumulation ≥100 g/m^2. The modelling did not predict shoreline accumulation at, or above the 10 g/m^2 threshold from Reindeer condensate from the LOWC scenario. The modelling results predicted shoreline oil accumulation on the Northern Islands Coast EVA with probabilities exceeding 10 g/m^2 and 100 g/m^2 thresholds for a condensate pipeline leak from the CSB and HDD scenarios. The minimum times before shoreline oil accumulation had occurred were 2 hours and 3 hours for each threshold, respectively. Protection and deflection activities are therefore considered appropriate where it is safe and practical to implement and where priority protection areas are at risk of impact from Reindeer condensate. Given the low probability and concentrations of shoreline accumulation for Reindeer condensate this strategy is considered a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✓ 2	✓ 2	Considered if operational monitoring shows or predicts contact with sensitive shorelines. **MDO (Scenario 4, 5 & 6)** • Modelling predicts low probabilities (<5%) for shoreline accumulation ≥100 g/m^2 for most scenarios (Scenario 4 = no contact predicted; Scenario 5 =≤1.33%), with the exception of Northern Islands Coast (scenario 3 = 11% and scenario 6 = 28%). • Shoreline accumulation volumes are predicted to be low for Scenario 4 (2 m^3); and Scenario 5 (24 m^3) and moderate for Scenario 6 (199 m^3) in the worst-case replicate simulations. **Reindeer Condensate (Scenario 1, 2 & 3)** • Modelling predicts no shoreline contact ≥100 g/m^2 for scenarios 1 and 2 and low probabilities of contact with shorelines for scenario 3. • No shoreline accumulation is predicted ≥100 g/m^2 for scenarios 1 and 2, and shoreline accumulation volumes are predicted to be low for Scenario 3 = 8 m^3

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
				Shoreline clean-up activities can result in physical disturbance to shoreline habitats. Given the high rates of natural biodegradation of MDO and Reindeer Condensate, it would be better to focus on high priority areas for clean-up. This strategy is considered to be a secondary response strategy for MDO and Reindeer Condensate where it is safe and practical to implement and where Protection Priority Areas (PPAs) are at risk of impact.
Onshore response	Protection, onshore clean-up and monitoring	✓ 1	✓ 1	The onshore pipeline is buried to 1.2 m and containment by soil will slow initial spread of hydrocarbons. Contamination of groundwater is the main issue but in areas of the pipeline corridor with a shallow groundwater table, and which are subject to inundation after rainfall, contamination of surface waters may occur in which case the use of sorbent boom may be applicable. Site remediation of soil and groundwater will be under direction of DWER and will be detailed in a remediation action plan under Contaminated Site legislation.
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✓ 1	✓ 1	• Can be used to deter and protect wildlife from contact with oil. • Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines. Potential for onshore releases to impact nesting areas. • Surveillance can be carried out as a part of monitor and evaluate activities or the fauna specific operational monitoring • Wildlife may become desensitised to hazing method. • Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging) • Permitting requirements for hazing and pre-emptive capture.
Operational and Scientific Monitoring	The monitoring of the effectiveness and potential impacts of response strategies; and the monitoring of environmental receptors to determine the level of impact from the oil spill and associated response activities that is sufficient to inform any remediation activities	✓ 1	✓ 1	Operational monitoring activities include: • hydrocarbon properties and weathering behaviour • water and sediment quality assessment • chemical dispersant effectiveness and fate assessment • rapid marine fauna surveillance • shoreline clean-up assessment Scientific monitoring activities include: • water and sediment quality assessment • intertidal and coastal habitat assessment • seabirds and shorebirds • marine megafauna assessment

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		MDO	Condensate	
				• benthic habitat assessment • marine fish and elasmobranch assemblages assessment • fisheries assessment • heritage features assessment • social impact assessment The type and extent of operational and scientific monitoring will depend upon the nature and scale of hydrocarbon contact to sensitive receptor locations. Pre-defined initiation criteria exist for operational and scientific monitoring.

6.5 Onshore spill zone of potential impact

As described in Table 6-3 the onshore spill scenario's maximum credible spill relates to the release of 121.4 m^3 of condensate due to a rupture of the export pipeline (16" DC supply pipeline) (11.1 km, from Gnoorea Point to gas plant boundary). The pipeline is buried 1.2 m below surface along 40 Mile Beach Road reserve adjacent to Mardie and Karratha Stations pastoral leases.

Santos will activate emergency shutdown (ESD) as first strike response to 'control' the spill. Maximum spill volume of 121.4 m^3 is the maximum volume remaining in the entire pipeline between isolation points (from WHP to the DCGP). It is unlikely for an onshore rupture to release the entire pipeline volume due to its length and gradient (sloping downward towards the sea from the plant). This volume is therefore considered very conservative for planning purposes.

6.5.1 Predicted spill fate and transport

The onshore section of the Devil Creek Supply Pipeline is below ground; therefore, it is unlikely that there will be any surface expression of condensate given the relatively low rate of condensate flowing the bottom section of the gas supply pipeline and the porosity of the sediments. However, the exception to this could be if the spill occurs at the saline flat section (Figure 6-1). This section has a shallow water table and is subject to inundation after a rainfall/storm event (not tidal influence). Due to the condition, this part of the onshore pipeline section has concrete coating to control the buoyancy forces acting on the pipeline to ensure its integrity at all times. The pipeline section cutting across the saline flats which may flood during rainfall may also be the point where oil can pool if the rupture occurs up gradient of this point i.e. from south-east towards north-west direction of the pipeline route.

Depending on where the rupture occurs, the rate at which the oil percolates down through the subsurface layers before reaching the groundwater table may vary significantly due to the varying water tables and soil profiles. The groundwater table in the vicinity of the pipeline section closer to the gas plant location will likely be contacted much later due to the deep-water table levels (10.9 m -15.1 m AHD) in the area (Figure 6-1). This will contrast significantly when compared to the sections of the pipeline towards the shoreline, particularly at the saline flats area, where the depths are shallower therefore resulting a faster contact time.

Notwithstanding surface expression of the spill at a specific location described above, sub-surface risk to soil and the groundwater system is the most likely exposure pathway. The exposure pathways based on a site conceptual model are described in detail in Section 6.6.2.1.

The inferred groundwater flows indicate a likely hydraulic gradient flowing from south-east to north-west (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west (Figure 6-1).

6.5.2 Predicted effect to the groundwater system

Based on extensively studied spill sites such as the pipeline crude oil spill near Bemidji in the US, fundamental knowledge derived pertaining to the fate and transport of hydrocarbons in the subsurface has been applied to the understanding of the soil and groundwater contamination risk of the Devil Creek onshore pipeline spill scenario. In the case of the Bemidji spill even after 16 years, the leading edge of the plume[18] of ground water containing BTEX had moved only about 200 m down hydraulic gradient, whereas advective flow of ground water since the spill has been about 500 m. The primary reason is that hydrocarbons get biodegraded under natural attenuation processes and evidence suggests that the spill reaches equilibrium and stabilises. This condition is likely to be analogous to the Devil Creek onshore pipeline spill scenario thus affecting limited areas of the aquifer around the spill site as shown in Figure 6-1. The groundwater dissolved contaminant plume extent is estimated to have a potential to move 200 m from leak/rupture point to either side of the pipeline within a year and this is under conservative conditions. This Zone of Potential Impact was derived based on the modelled estimates provided in a detailed general pipeline spill assessment[19]. The basis for estimating the 200 m extent was based on the assumption that the soil type is representative of the loamy to sandy soil profiles used in the US study. Soil profiles within the onshore pipeline sections vary considerably as described in Section 6.6.2.

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[18] Note that this different to the leading edge of the oil floating (free phase oil or Light Non-Aqueous Phase Liquid [LNAPL]) on the water table which had moved 40 m down the hydraulic gradient since the spill. The former refers to the contamination plume that contains concentrations of dissolved constituents such as BTEX. Although the plume migration characteristics are influenced by the actual ground-water flow velocities and sorption constants for these compounds, the behaviour of the plume are expected to be similar.

[19] Pipeline Spill Model Report prepared for Summit County to define appropriate setback distances for varying land conditions and spill scenarios. Full reference included in the References Section 19.

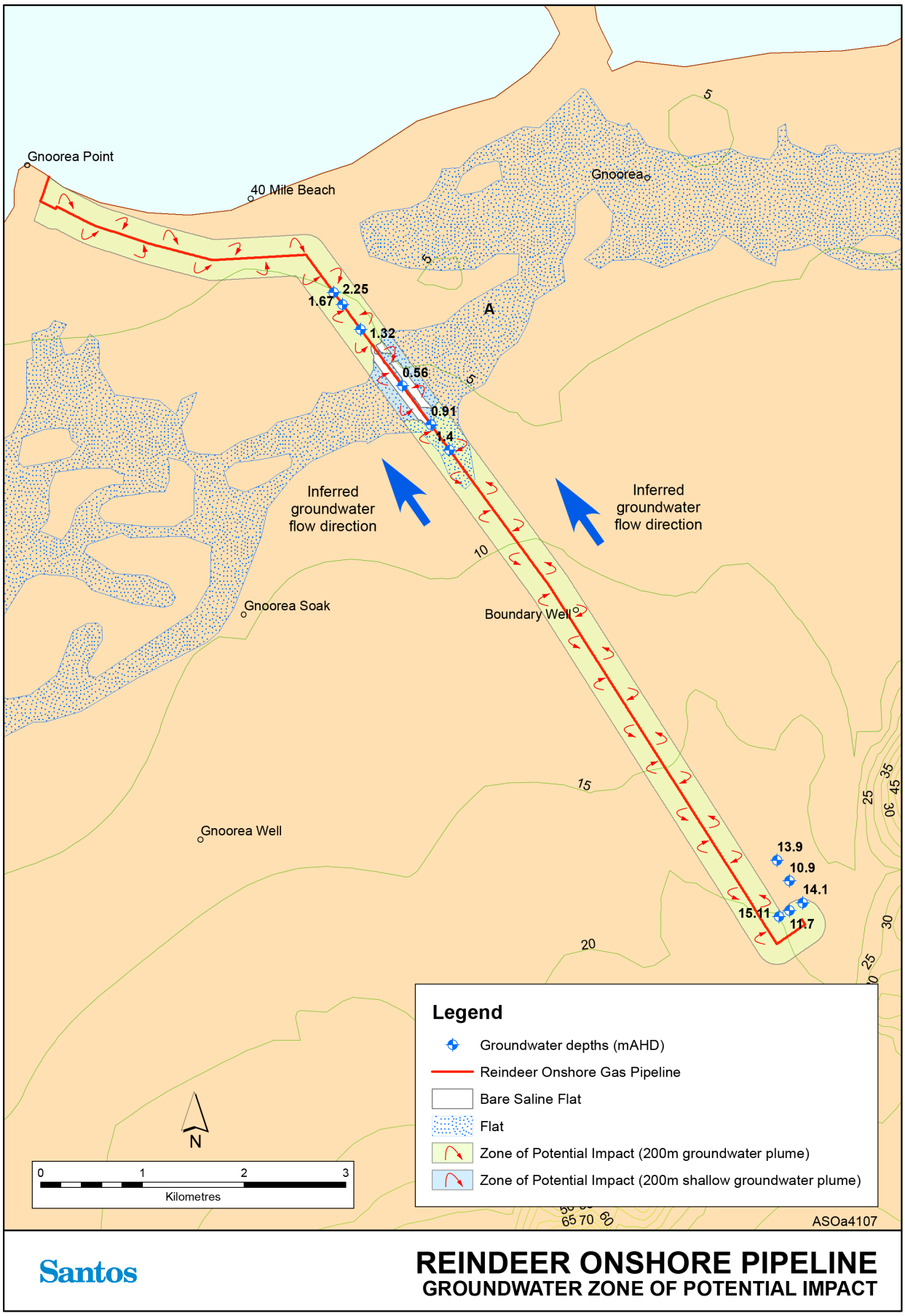

Figure 6-1: Reindeer Onshore Pipeline Groundwater zone of potential impact

6.6 Identification of priority protection areas and initial response priorities

Prioritising receptors helps identify where available resources (for response and/or monitoring) should be directed for the best effect. It enables the control agency to make informed decisions, and ultimately in the development and execution of an effective response strategy.

Combined spill modelling results were used to predict the EMBA for the Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan (EP) (7715-650-EMP-0023) and the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP) (7715-650-EMP-0022-01). The EMBA is the largest area within which effects from hydrocarbon spills associated with this activity, could extend. Within the EMBA, priority protection areas (PPAs) have been identified. Priority protection areas are emergent features (i.e. coastal areas and islands) that are predicted to be contacted above moderate exposure values at greater than 5% probability and would be targeted by nearshore spill response operations such as protection and deflection and shoreline clean-up.

The Reindeer WHP and Offshore Gas Supply Pipeline Operations Environment Plan (EP) (7715-650-EMP-0023) and the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan (EP) (7715-650-EMP-0022-01) describe the basis for determining hot spots and protection priority areas. These are described in EP Sections 7.6 to 7.8 for the LOWC, pipeline leak and MDO spill scenarios respectively in the Commonwealth EP and Sections 7.7 and 7.8 for the pipeline leak and MDO scenarios respectively in the State EP.

6.6.1 Offshore Spill

Table 6-10 shows the rationale for the hotspots that were selected as PPAs from the list of contacted receptors from the surface LOWC, pipeline and MDO release scenarios.

Table 6-10: Determination and rationale for the protection priority areas

Hotspots	Type	HEV Ranking	Hotspot	PPA	Rationale
Barrow Island	Emergent	3	Y (discretionary) MDO spill at CSB (Scenario 5)	N	<5% at moderate exposure and low shoreline volumes
Barrow-Montebello Surrounds	Submerged	3	Y LOWC scenario (Scenario 1)	N	Not an emergent feature
Lowendal Islands	Emergent	3	Y MDO spill at CSB (Scenario 5)	N	<5% at moderate exposure
Montebello Australian Marine Park (AMP)	Submerged	3	Y LOWC scenario (Scenario 1) & MDO spill at WHP (Scenario 4)	N	<5% at moderate exposure for both scenarios
Montebello Islands	Emergent	3	Y MDO spill at CSB (Scenario 5)	N	<5% at moderate exposure
Northern Islands Coast	Emergent	3	Y Pipeline leak at HDD (Scenario 3) MDO spill at HDD (Scenario 6)	Y	>5% moderate exposure and shoreline loading along coastline for both spill scenarios
Dampier Archipelago	Emergent	4	Y (discretionary) MDO spill at CSB (Scenario 5) Y MDO spill at HDD (Scenario 6)	Y	Yes - >5% at moderate exposure for HDD only Yes- shoreline loading for both scenarios
Glomar Shoals	Submerged	5	Y (discretionary due to high HEV value)	N	Not an emergent feature

Table 6-11 lists the key sensitivities and associated locations within the PPAs identified for the worst-case spill scenario for a LOWC (Reindeer condensate), pipeline leak (Reindeer condensate) and vessel collision (MDO). The ranking of these sensitivities (also referred to as receptors) are listed, which is consistent with the rankings in the Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (Advisian 2017). Using a combination of sensitivities, and their associated rankings; together with the modelled maximum total volumes ashore and minimum time to shoreline contact, an initial response priority is provided in Table 6-11. This information is designed to aid decision making in the preliminary stages of the response operation, so that initial resources are used for best effect.

Note, the PPAs for response also correspond with the wildlife priority protection areas presented in Section 15, with further detail on the species that may be present and key locations provided in Table 6-11.

Table 6-11: Initial response priorities for LOWC (Reindeer condensate) (Scenario 1), pipeline leak (Reindeer condensate) (Scenario 2 & 3) and vessel collision (MDO) (Scenario 4,5 & 6)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[20]	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Min. arrival time accumulated oil ashore ≥100 g/m^2 (hours)	Initial response priority
Dampier Archipelago	Mangroves	3	3	West Intercourse and Enderby	N/A	Vessel collision at CSB (MDO) (Scenario 5) 24m^3 Vessel collision at HDD (MDO) (Scenario 6) 9m^3	Vessel collision at CSB (MDO) 58 hours (2 days, 10 hours) Vessel collision at HDD (MDO) 115 hours (4 days,19 hours)	Medium
	Turtles • Hawksbill turtle (*Eretmochelys imbricata*)- Critically Endangered • Green turtle (*Chelonia mydas*) - Endangered • Flatback turtle (*Natator depressus*)- Nesting and breeding	4	3	Enderby Island, Rosemary Island, Keast Island, Legendre Island, Delambre Island, Dixon Island, Bells Beach, Cooling Water Beach Hawksbill turtle- NW of Rosemary Island and Legendre Island Flatback turtle- Legendre Island and Delambre Island are particularly important.	Nesting Sept-Dec Hatching Jan-April			High
	Physical habitats • Coral reefs and other subsea benthic primary producers	3	4 corals are particularly sensitive to dissolved hydrocarbons		Coral spawning: Mar and Oct			Medium
	Birds • Little corella (*Cactua sanguinea*), boobies (*Sula* sp.) and noddys (*Anous* sp). • Behavioural BIA: Fairy Tern (breeding), Roseate Tern (breeding), Wedge-tailed Shearwater (breeding)	2	1	Widespread. Seabird nesting- breeding on Goodwyn, Keast Islands, Nelson Rocks Keast Island provides one of the few nesting sites for pelican (*Pelecanus sp*) in WA.	Fairy tern breeding from July to September Roseate Tern breeding from mid-			Medium

[20] *Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (Advisian 2017).*

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[20]	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Min. arrival time accumulated oil ashore ≥100 g/m^2 (hours)	Initial response priority
					March to July			
	Marine Mammals • Eight species (including dugong (Dugong dugon)- Vulnerable, humpback whale (Megaptera novaeangliae)- Nursing area • Migratory pathway for protected humpback whale in July-Sept. • Humpback whale- Migration BIA Protected Area • Commonwealth Marine Reserve	3	2		Humpback whale peak migration between Jun –Aug Dugong breeding Mar-Aug. Dugong mating Aug-Mar.			Low
	Socio-economic and heritage values • Recreational fishing/ charter boats, tourism related to water-based activities and nature • Aboriginal rock art on shorelines, Burrup Peninsula • Camping beaches • Shipping fairway	3	2	Widespread	Year round			Low
	Cultural Heritage National Heritage Property: Dampier Archipelago (including Burrup Peninsula)	4	4					Medium
Northern Islands Coast	Physical habitats • Coral reefs and other subsea benthic primary producers • Seagrass beds surrounding many small islands.	3	4		Coral spawning: Mar and Oct Regnard Islands seagrass beds likely to support foraging dugongs (*Dugong dugon)*	Pipeline leak at HDD (Scenario 3) $8m^3$ Vessel collision at HDD (MDO) (Scenario 6)	Pipeline leak at HDD 3 hours Vessel collision at HDD (MDO) 2 hours	Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[20]	DoT Ranking (Dissolved oil)	Key locations	Relevant key periods	Peak volume ashore (m^3)	Min. arrival time accumulated oil ashore ≥100 g/m² (hours)	Initial response priority
	<u>Turtles</u> • Hawksbill turtle (*Eretmochelys imbricata)*- Critically Endangered • Green turtle (*Chelonia mydas)* - Endangered • Flatback turtle (*Natator depressus)*- Nesting and breeding	4	3	Turtle nesting and breeding sites in many of the islands in this region.	Nesting Sept-Dec Hatching Jan-April	199m^3		High
	<u>Birds</u> • Seabird nesting, including pelican (*Pelecanus sp.*), wedge-tailed shearwater (*Puffinus pacificus*) and pied cormorant (*Phalacrocorax varius*). • Behavioural BIA Fairy Tern (breeding) , Roseate Tern (breeding), Wedge-tailed Shearwater (breeding)	2	1	Widespread	Fairy tern breeding from July to September Roseate Tern breeding from mid-March to July			Medium
	<u>Marine Fauna</u> • Grey Nurse Shark nursery area							
	<u>Socio-economic and heritage values</u> • Onslow prawn managed fishery • Beech-de-mer fishery • Tourism beaches • Minor indigenous heritage sites • Recreational fishing/ charter boat tourism	3	2	Tourism beaches- Dolphin Island beach				Low

6.6.2 Onshore Spill

The existing sensitivities surrounding the onshore pipeline section is shown in Figure 6-2. The coverage of the area shown in the map is broad and not limited only to the area most probably affected if an onshore pipeline spill occurs. The relevant environmental settings, values and sensitivities potentially exposed to an onshore pipeline spill are detailed in the Table 6-12.

Table 6-12: Onshore environmental features and sensitivities

Feature/Element	Description of the feature/element
Site Features	
Landforms/Topography	The topography of the areas generally shows a gradual fall in elevation from the 20 m AHD elevation from the gas plant location (south-east) towards the Indian Ocean (about 11 km to northwest of the plant).
Surface water	The nearest surface water is Devil Creek an ephemeral creek located about 200 m to the east of the pipeline alignment. This creek drains to the north and topography of the pipeline section close to the gas plant site does not appear to allow natural drainage of surface water to the creek as majority of the site slopes towards the north.
Soil Profile	The typical subsurface profile in the area closer to the gas plant is mainly made up of clayey silt to sandy clayey silt on the top layer and (0 m-1.8 m). Layers beneath are made up of conglomerates (1.8 m to 4.1m and calcarenite limestone (1.8m to >8m). The profile varies for sections along the pipeline route along 40 Mile Beach Road. Based on geotechnical data two distinct conditions were reported. For the sections closer towards the shoreline, the subsurface profile comprised silty sand overlying calcarenite rock containing some calcrete layers. The remaining section of the route towards the plant site comprise of varying profile generally including silty sand, clayey sand clayey silt, silty clay gravelly clay and many other composition combinations. In several locations the test pit met refusal on rock above the target depth. Perched groundwater tables on silty and clayey soils may occurs following periods of rainfall. The above profiles were based on the pre –construction surveys. It should be noted for the installation to layer above the top of the pipe have been replaced with compacted sand fill material with most of the excavated spoil has been re-used as backfill. Pipe laying involved removing topsoil and replacing with gravel
Groundwater hydraulic gradient and quality	Groundwater quality is expected to be mostly freshwater/brackish making potential beneficial use limited to mainly irrigation, industrial processes but drinking water will require desalination. Sub-surface groundwater flows are considered to most likely have a hydraulic gradient flowing from east to west (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west
Sensitivities/Value Potentially Affected	
Flora	The vegetation in the area has been disturbed by activities which occurred prior to the pipeline operations. Weed proliferation (particularly Buffalo grass) is common and no species of ecological significance is present in the area. The condition of the vegetation is influenced by the seasons and although controlled weed proliferation is still occurs reducing native species cover and diversity. This is also attributed to the external factors such as public vehicle, road maintenance livestock activities causing continuous disturbance. Most significant sensitivity include a single species (*Avicennia marina*) sparse mangrove stand on the west side of Gnoorea Pt, adjacent to the pipeline shore crossing.
Fauna	Fauna of ecological significance in the area are mainly associated within the shoreline location were the mangroves occur (most abundant on the western face of Gnoorea Point) or sandy beach areas adjacent to the pipeline. These include the 54 vertebrate fauna specific of conservation significance expected to be found in the area. Majority are birds likely to be found in the intertidal zone or mangroves areas. However protected fauna including mammals (including the Northern Quoll; Greater Bilby) and reptiles (including turtles). Stygofauna which belong to the freshwater aquatic ‘subterraneous’ ecosystem (not high conservation significance in the context of its occurrence in the area) have been found in the groundwater system.
Socio-Economic Receptors	The area along the beach adjacent to the pipeline close to the shoreline at Gnoorea point is a camping site with a boat ramp. The 40 mile beach road adjacent and parallel to the on shore pipeline route is the main access to the 40 mile beach. 40 Mile Beach Road pipeline reserve is adjacent to Mardie and Karratha Stations pastoral leases. Livestock may be exposed in the event of a spill.

Feature/Element	Description of the feature/element
	A significant sensitivity include a groundwater bore/well (Boundary Well) located less than 200m from the pipeline. Based on the data search available from the Department of Water's Groundwater Bore Database (WIN), it is possible that the bore water can be used for livestock purpose, however, unable to verify if the data is current. In addition to Santos operated wells there are few other wells (outside Santos facility) in the surrounding area, however, not expected to be within the potential zone of impact.

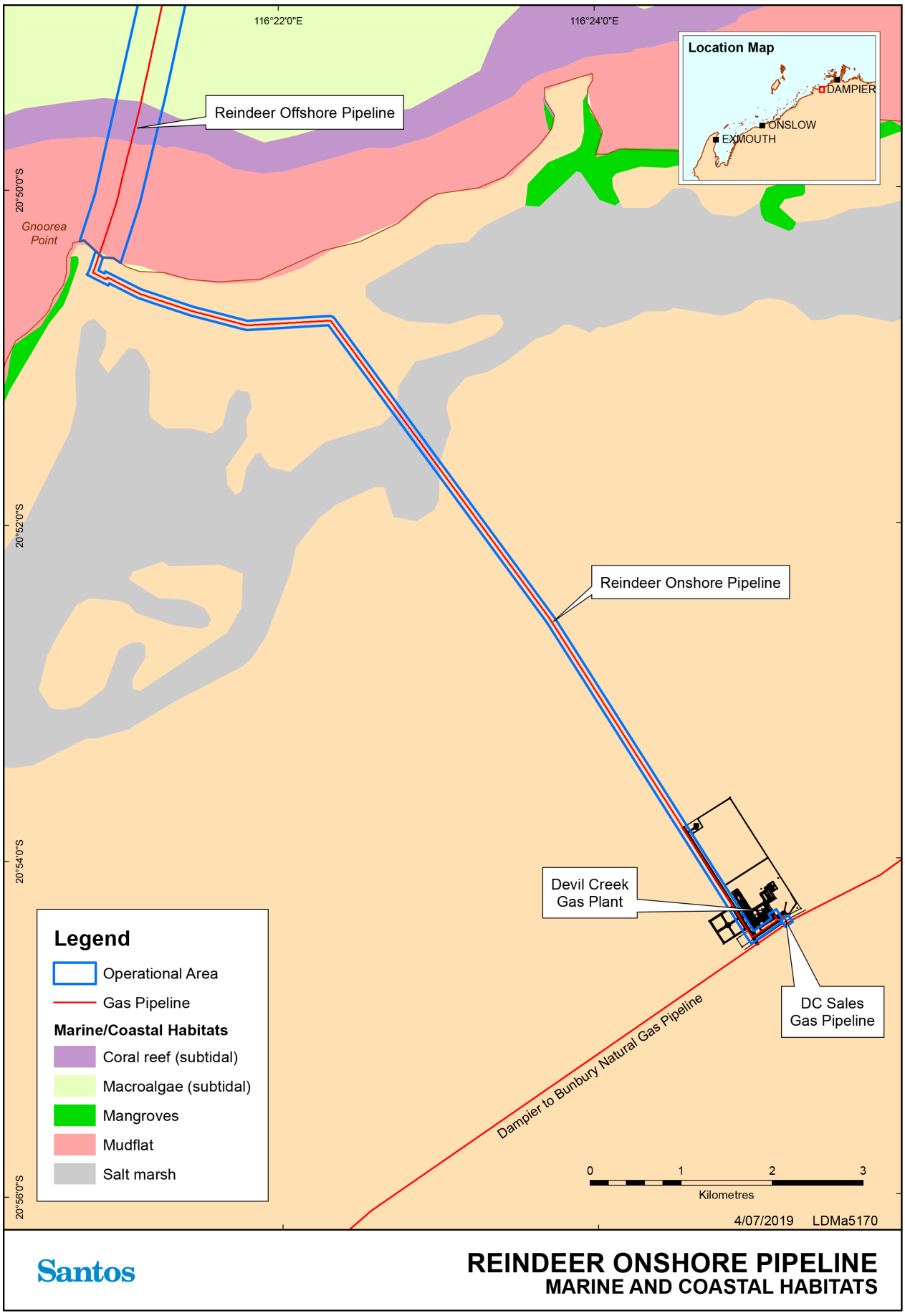

Figure 6-2: Onshore Pipeline Environmental Habitat

6.6.2.1 Conceptual Model

A preliminary understanding of the exposure risk due to the pipeline spill is described here based on the conceptual site model (Figure 6-3) developed by Coffey Environments (2009) for a potential spill nearby the gas plant. This model supported a preliminary site investigation conducted during pre-construction phase of the Devil Creek Gas Plant facility. The key sensitivities represented being exposed to contamination risk is likely to be the same identified for the pipeline.

In reference to a potential exposure pathway to surface water systems, in accordance with the preliminary site investigation, the migration of groundwater off-site to impact on a freshwater aquatic ecosystem exposure scenario was not considered to be complete given Devil Creek is an ephemeral feature and not considered to be hydraulically connected to the groundwater flow system.

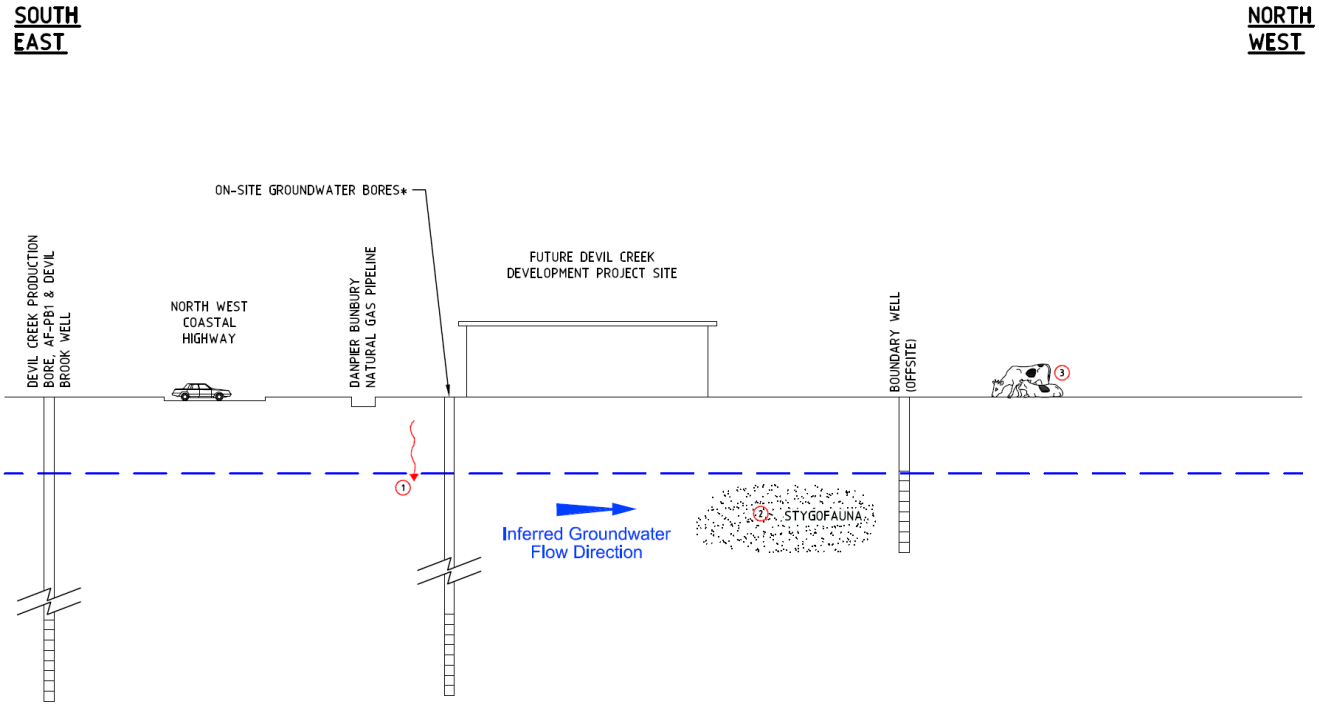

Figure 6-3: Conceptual site model for pipeline spill near the DCGP

6.6.3 Tactical response plans for priority protection areas

Santos Tactical Response Plans (TRPs) are in place for certain receptors (Table 6-13), identifying suitable response strategies, equipment requirements, relevant environmental information, and access and permit requirements. TRPs are to be used by the IMT for first strike and ongoing activities and to assist in informing the appropriate responses for inclusion in an IAP.

Not all PPA's require TRPs in place. The requirement for a TRP considers the hydrocarbon type, predicted time to contact to a PPA from accumulated or floating hydrocarbons in <10 days (above the response planning thresholds defined in Section 6.2). Ten days allows two days to get services procured; six days to draft the TRP; and two days to implement. The Sensitivity Ranking (HEV and DoT), and accessibility (i.e. on mainland compared to a remote island location) are also considered.

A TRP will also be considered should the impact from hydrocarbons be considerable (high accumulation, large floating oil contact). Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA. Additionally, TRPs for contacted receptors will be sought from other operators where available.

Table 6-13 has the tactical response plan evaluation for the Dampier Area of Operation PPA.

Table 6-13: Tactical response plans for priority protection areas

PPA	TRP Evaluation	Existing TRP
Dampier Archipelago	A TRP already exists for Dampier Area of Operation • Dampier 1: Legendre Island • Dampier 2: Rosemary Island • Dampier 1: Enderby Island	Yes

6.7 Net environmental benefit analysis (NEBA)

The IMT uses a NEBA, also referred to as a spill impact mitigation assessment (SIMA), to inform the incident action planning process (Section 8), so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed.

The Environment Unit Leader will use the information in Section 6.6 to identify and prioritise initial response priorities and apply the NEBA to identify which response strategies are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

As a component of the incident action planning process, NEBA is conducted by the Control Agency with responsibility for the spill response activity. Where there are different activities controlled by different IMTs, as in a cross-jurisdictional response between Santos and DoT, consultation will be required during the NEBA process such that there is consistency in the sensitivities prioritise for response across the Control Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to credible spills identified in this OPEP (both condensate and MDO), with the benefit or potential impact to each sensitivity identified within the EMBA and Scientific Monitoring Planning Area (refer Table 6-14 for condensate and Table 6-15 for MDO). While not all spill response activities included in the strategic NEBA would be under the control of Santos during a spill incident they have been included to assist in planning conducted by DoT.

In the event of a spill, NEBA is applied with supporting information collected as part of the Monitor and Evaluate Plan (Section 10) to achieve the following:

- Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonal).
- Assist in prioritising and allocating resources to sensitivities with a higher ranking (Table 6-11); and
- Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised. Operational NEBA Templates are filed within the Environment Unit Leader folder on the Santos ER Intranet site. To complete the Operational NEBA:

- All ecological and socio-economic sensitivities identified within the spill trajectory area are inserted; and
- Potential effects of response strategies on each sensitivity are assessed and assigned a positive, negative or no change rating; and
- All persons involved and data inputs have been considered for the analysis

The Operational NEBA Form documents the decisions behind the recommendation to the Incident Commander on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The Operational NEBA/SIMA provides guidance to the IAPs and is revisited each Operational Period.

6.8 Oil spill response ALARP assessment

For each response strategy included within this OPEP an environmental performance outcome has been determined and key control measures and performance standards have been identified such that the response can meet the required performance outcome. For each response strategy, an ALARP assessment has been conducted to demonstrate that the control measures mitigate the risk of an oil spill to ALARP.

Appendix B details the ALARP assessment framework and the results of the ALARP assessment conducted to inform the control measures and performance standards contained within this OPEP.

Table 6-14: Strategic net environmental benefit analysis matrix for Reindeer condensate

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Operational and Scientific Monitoring
Dampier Archipelago								
Turtle nesting –particularly flatback and green turtles								
Mangroves and mudflats (shorebird foraging)							N/A	
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Seabird nesting								
Migratory shorebirds								
Aboriginal listed sites incl. pearling camps								
Northern Islands Coast								
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Grey Nurse Shark Nursery Area						N/A	N/A	
Commercial Fisheries						N/A	N/A	
Aboriginal listed sites							N/A	
Tourism Beaches (inc. Dolphin Beach)							N/A	
	Beneficial impact.							
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions).							
	Negative impact.							
N/A	Not applicable for the environmental value.							

Table 6-15: Strategic net environmental benefit analysis matrix table for MDO

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Operational and Scientific Monitoring
Dampier Archipelago								
Turtle nesting –particularly flatback and green turtles								
Mangroves and mudflats (shorebird foraging)							N/A	
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Seabird nesting								
Migratory shorebirds								
Aboriginal listed sites incl. pearling camps							N/A	
Northern Islands Coast								
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Grey Nurse Shark Nursery Area						N/A	N/A	
Commercial Fisheries						N/A	N/A	
Aboriginal listed sites							N/A	
Tourism Beaches (inc. Dolphin Beach)							N/A	
	Beneficial impact.							
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions).							
	Negative impact.							
N/A	Not applicable for the environmental value.							

7. External notifications and reporting requirements

The Devil Creek Emergency Response Plan (DC-40-IF-00096) identifies the initial incident notifications and actions to be conducted by onsite personnel, including notifying the incident to the Emergency Commander (Facility OIM) and Devil Creek Central Control Room (CCR) and initial notification of emergency services where applicable.

For oil spill incidents, the Emergency Commander will notify the Perth-based IMT for delegation of further notifications to relevant Regulatory Authorities and for further spill response assistance for Level 2/3 spills.

7.1 Notification and reporting

Environment incident notification and reporting requirements for Devil Creek facilities are contained within the Environment Incident Notification Guideline and Matrices (QE-91-HF-10003) and should be consulted as the primary source of Regulatory reporting requirements for all environmental incidents at Devil Creek facilities.

Table 7-1 outlines regulatory reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth and State jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using onsite resources as well as larger Level 2/3 spills. State water notifications will apply for spills originating in Commonwealth waters if the spill moves from Commonwealth to State waters. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and WA DoT (MEER unit).

In the event of a Level 2 or 3 spill event, Santos will review the Relevant Persons identified in Section 4 of the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations EP (Onshore & State Waters) (7715-650-EMP-0022-01), and in Section 4 of the Reindeer WHP and Offshore Gas Supply Pipeline Operations EP for Commonwealth Waters WA-41-L and WA-18-L (7715-650-EMP-0023), to identify those potentially affected. All stakeholders that may be affected by the spill event or response arrangements will be identified and engaged in accordance with the Santos incident management process.

Table 7-2 outlines the Regulatory Notification and reporting for Onshore Pipeline Spills.

Contact details for the Regulatory agencies outlined in Table 7-1 and Table 7-2 are provided within the Company Incident Response Telephone Directory (7700-650-PLA-0016.20). Contact details are kept within a separate document to ensure currency of the information is maintained. This would avoid risk of a superseded version being accessed during an incident.

7.2 Activation of external oil spill response organisations and support agencies

Table 7-3 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined within this plan. This list contains key OSROs that have pre-established roles in assisting Santos in an oil spill response. It is not an exhaustive list of all providers that Santos may use for assisting an oil spill response.

The Incident Response Telephone Directory (7700-650-PLA-0016.20) contains a more detailed list and contact details for incident response support and is updated every six months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.3 Environmental performance

Table 7-4 lists the environmental performance outcome, control measures, performance standards and measurement criteria for external notifications and reporting.

Table 7-1: External notification and reporting requirements (Commonwealth and State waters)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within two hours Written report as soon as practicable, but no later than three days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2023	A spill associated with the activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by Planning Section Chief (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator)	Written report to NOPTA within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by Planning Section Chief (or delegate)	Provide same written report as provided to NOPSEMA
DEMIRS Reporting Requirements for State water spills					
WA Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) (Petroleum Environment Duty Officer)	Verbal phone call within 2 hours of incident being identified Follow up written notification within 3 days	Regulations 28, 29 and 30 of the Petroleum (Submerged Lands) (Environment) Regulations 2012 Guidance Note on Environmental Non-compliance and Incident Reporting	All actual or impending spills in State waters	Notification by Planning Section Chief (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Documents/Environment/ENV-PEB-189.docx
Energy Policy WA (part of DEMIRS)	Notification in the event of production disruption		Notification in the event of production disruption	Notification by IMT Planning Section Chief (or delegate)	None, however, provide copy of above Environmental and Reportable Incident/ Non-compliance Reporting Form for information.
AMSA, DoT and Pilbara Ports Authority spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within two hours of incident Written POLREP form, within 24 hours on request from AMSA	MARPOL	Santos to notify AMSA of any marine pollution incident[1]	Notification by Planning Section Chief (or delegate)	https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Transport (WA DoT)[2] (Maritime Environmental Emergency Response (MEER) Duty Officer)	Verbal notification within two hours Follow up with Pollution Report (POLREP) (Appendix C) as soon as practicable after verbal notification If requested, submit Situation Report (Appendix D) within 24 hours of request	*Emergency Management Act 2005* State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos to notify of actual or impending Marine Pollution Incidents (MOP) that are in, or may impact, State waters. Emergency Management Regulations 2006 define MOP as an actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment[1].	Notification by Planning Section Chief (or delegate) MEER Duty Officer contacted per Incident Telephone Directory	WA DoT POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP: (Appendix D) https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
Port of Dampier / Port of Ashburton	Verbal notification immediately to Harbour Master via Dampier / Ashburton VTS. Call to The Emergency Tower mobile POLREP to WA DoT	*Port Authorities Act 1999* Pilbara Ports Authority, Port of Dampier Handbook *or* Port of Ashburton Handbook	For all spills within Port of Dampier or Port of Ashburton port limits	Notification by Vessel Master, Emergency Commander (OSC), or Facility Emergency Response Team (ERT)	WA DoT POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf
Port of Varanus Island (VI) (Pilbara Ports Authority)	Verbal notification within 4 hours to Harbour Master via VI Port Control. Follow up report within 48 hours through the Pilbara Port Authority Hazard and Incident Reporting Form: https://www.pilbaraports.com.au/safety-and-security/hazard-and-incident-reporting	*Port Authorities Act 1999* Pilbara Ports Authority Port of VI Handbook	For all spills within Port of VI limits	Notification by Vessel Master, On-scene Commander (OSC), or Facility Emergency Response Team (ERT)	WA DoT POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
	Follow up with POLREP as soon as practicable after verbal notification				
Varanus Island Contaminated Sites Auditor	Initial verbal or electronic notification followed by a report if confirmed contamination	*WA Contaminated Sites Act 2003*	Applies if there is shoreline contact that could cause land contamination on Varanus Island and/or Airlie Island	Notification by Planning Section Chief (or delegate)	Not applicable.
Protected areas, fauna and fisheries reporting requirements					
Commonwealth Department of Climate Change, Energy, the Environment, and Water (DCCEEW) (Director of monitoring and audit section, Director of National Parks)	Email notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	If Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, when entrained oil concentrations ≥10 ppb are predicted by incident oil spill modelling to contact MNES, or where there is death or injury to a protected species	Notification by Planning Section Chief (or delegate)	Not applicable
WA Department of Biodiversity Conservation and Attractions (State Duty Officer and Pilbara Regional Office)	Verbal notification as soon as reasonably practical	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Adviser)	Notification by Planning Section Chief (or delegate)	Not applicable
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by Planning Section Chief (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OSCP

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
					Confirmation of providing access to relevant monitoring and evaluation reports when available Details of the relevant contact person in the IMT
Department of Primary Industry and Regional Development (DPIRD) Fisheries	Verbal phone call notification within 24 hours of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution1 Notify if spill has the potential to impact or has impacted fisheries in State waters	Notification by Planning Section Chief (or delegate)	Not applicable
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution1 Fisheries within the EMBA and/or Scientific Monitoring Planning Area) Consider a courtesy call if not in exposure zone	Notification by Planning Section Chief (or delegate)	Not applicable
Department of Water and Environmental Regulation (DWER)	Initial verbal or electronic notification of the discharge as soon as practicable. Written notification of the incident to the CEO of the DWER, copied to the local DWER Industry Regulation Office, as soon as practicable.	*Environmental Protection Act 1986* (Section 72) *Environmental Protection (Unauthorised Discharge) Regulations 2004*	Call DWER 24 hour Pollution Watch hotline *Environmental Protection Act*: Spill or discharge of hydrocarbons to the environment that has caused, or is likely to cause pollution, or material or serious environmental harm (Level 2 / 3 spills)	Notification by Planning Section Chief (or delegate)	Reporting requirements: https://www.wa.gov.au/service/environment/pollutant-prevention/pollution-watch

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
			Environmental Protection (Unauthorised Discharge) Regulations: Unauthorised discharge (where there is potential for significant impact or public interest) to environment of Schedule 1 material		
Others					
First Nations groups or Registered Native Title Bodies Corporate (RNTBC)	Verbal phone call notification - Verbal phone call within 12 hours of incident being identified. Follow up with email outlining details of incident.	Not applicable	All spills heading towards relevant parties' interests	Notification by Planning Section Chief (or delegate)	Not applicable
WAFIC and WA commercial fisheries	Phone call within 24 hours of incident being identified with potential impact to the WA commercial fisheries. Follow up with email where available.	As per consultation with WAFIC	Should impact be expected to WA commercial fisheries	Notification by Planning Section Chief (or delegate)	Santos' list of WA commercial fisheries for this activity

1. *For clarity and consistency across Santos regulatory reporting requirements, Santos will meet the requirement of reporting a marine oil pollution incident 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 of the EP.*
2. *Santos reporting requirements only listed. For oil spills from vessels, Vessel Masters also have obligations to report spills from their vessels to AMSA Rescue Coordination Centre (RCC) and, in State waters, WA DoT MEER.*

Table 7-2: Regulatory Notification and reporting for Onshore Pipeline Spills

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Fire and Emergency Services (DFES)	As determined by Devil Creek Emergency Commander (Facility OIM)	Devil Creek Emergency Response Plan (DC-40-IF-00096) State Hazard Plan for Hazardous Materials Emergencies	Refer Devil Creek Emergency Response Plan (DC-40-IF-00096)	Devil Creek Emergency Commander (Facility OIM)	Not applicable
WA Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	Verbal phone call within two hours of incident being identified Follow up written notification within three (3) days	Guidance Note on Environmental Non-compliance and Incident Reporting	All actual spills regardless of the source or quantity	Notification by Planning Section Chief (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx
WA Department of Water and Environmental Regulation (DWER)	Verbal or electronic notification as soon as practicable Follow up written notification as soon as reasonably practicable	Section 72 of the *Environmental Protection Act 1986*	All actual spills likely to cause pollution or environmental harm	Notification by Planning Section Chief (or delegate)	S 72(1) Waste Discharge Notification Form https://www.der.wa.gov.au/images/documents/your-environment/pollution/Notification_of_waste_discharges.pdf
Department of Biodiversity Conservation and Attractions (State Duty Officer)	Verbal notification within two hours	Western Australian Oiled Wildlife Response Plan *Reserves (National Parks, Conservation Parks and Other Reserves) Act 2004*	Notify if spill has the potential to impact or has impacted wildlife (to activate the Oiled Wildlife Advisor)	Notification by Planning Section Chief (or delegate)	Not applicable

Table 7-3: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
AMOSC Duty Officer	As soon as possible but within two hours of incident having been identified	Verbal Service Contract	Santos is a Participating Member of AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos can also call upon mutual aid from other trained industry company personnel and response equipment. AMOSC's stockpiles of equipment include dispersant, containment, recovery, shoreline clean-up, oiled wildlife and communications equipment. Equipment is located in Geelong (Victoria), Fremantle, Exmouth and Broome (all in WA)	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required – activate if spill response escalates in order to mobilise spill response resources consistent with the AMOSPlan **Step 3.** Email confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment. Only a Santos callout authority (registered with AMOSC) can activate AMOSC and will be required to supply their credentials to AMOSC. A signed contract note must also be completed by the Santos call out authority and returned to AMOSC prior to mobilisation.	Planning Section Chief (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	Phone call	Logistics Section Chief (or delegate)
Duty Officers/ Incident Commanders (Woodside, Chevron, Jadestone)	Within two hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual aid arrangement)	Phone call	Incident Commander (or delegate)
Exmouth Freight & Logistics	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call	Logistics Section Chief (or delegate)
North West Alliance - Waste	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	Logistics Section Chief Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
OSM Services Provider	Operational and Scientific Monitoring Plan initiation criteria are met (Tables 9-1 and 9-2 of the Joint Industry OSM Framework [APPEA, 2021])	Verbal and written	Santos is a member of OSRL's OSM Supplementary Service, providing access to personnel and equipment for operational and scientific monitoring.	Refer to North West Shelf OSM-BIP (7715-650-ERP-0002) Part B for full activation instructions Step 1. Obtain approval from Incident Commander to activate OSM Services Provider Step 2. Verbally notify OSM Services Provider followed by the submission of the Call Off Order Form Step 3. OSM Service Provider commences activation process	Environment Unit Leader (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When Operational Monitoring Plans (OMP): Hydrocarbon Properties and Weathering Behaviour is activated (Section 16)	Verbal	Oil analysis including gas chromatography/mass spectrometry fingerprinting	Phone call	Planning Section Chief (or delegate)
Oil Spill Response Limited, OSRL Duty Manager	Within two hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form	Santos has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios. At minimum OSRL will provide technical support to the IMT and place resources on standby Further details available on the OSRL webpage.	**Step 1.** Contact OSRL Duty Manager in Singapore and request assistance from OSRL. **Step 2.** Send notification to OSRL as soon as possible after verbal notification. **Step 3.** Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby. **Step 4.** Mobilisation of personnel (beyond 5 technical advisors x 5 days) and equipment requires signed mobilisation form by designated call-out authorities.	Designated call-out authorities (including Incident Commanders)
RPS Group	As soon as possible but within two hours of incident having been identified	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group	Contact RPS Group Duty Officer	Planning Section Chief (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Wild Well Control Inc (WWCI)	Within four hours of a loss of well control incident having been identified	Loss of well control only Verbal	Well intervention services. Under contract.	As per Source Control Planning and Response Guideline (DR-00-OZ-20001): **Step 1.** Following Santos management confirmation of a LOWC, the Santos Incident Command Team (IMT) Drilling Representative is to call the Wild Well Control 24-hour emergency hotline number to notify WWC of the incident. **Step 2.** As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form must be filled out, signed off by the authorised Santos Manager and sent through to WWCI. Obtain the most current emergency mobilisation form from the WWCI emergency hotline attendant. The form shall be submitted as directed by WWCI, as advised by the emergency hotline attendant.	Drilling Representative

Table 7-4: Environmental performance – external notification and reporting

Environmental performance outcome	Make notifications and reports within regulatory and defined timeframes.		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
External notifications and reporting plan	**Response preparedness**		
	Santos Incident Response Telephone Directory (7700-650-PLA-0016.20)	[EPS-RP-001] Incident Response Telephone Directory is revised every six months	Incident Response Telephone Directory Document revision history
	OPEP communications test	[EPS-RP-002] OPEP contact details for regulatory and service provider notifications are checked annually	OPEP Communications Test records
	Response implementation		
	External notifications and reporting tables	[EPS-RP-003] External notification and reporting undertaken as per Table 7-1 and Table 7-2	Incident log

8. Incident Action Planning

The incident action planning process is built on the following phases:

1. Understand the situation
2. Establish incident priorities, objectives and tasks
3. Develop the plan (IAP)
4. Prepare and disseminate the plan
5. Execute, evaluate and revise the plan for the next operational period.

The Santos IMT will use the IAP process to determine and document the appropriate response priorities, objectives, strategies and tasks to guide the incident response which are reviewed and updated as more information becomes available. The IMT will use an IAP for each operational period following the initial first-strike assessments, notifications and activations undertaken.

When acting as the support agency, Santos may be requested by the Control Agency to develop or support the development of an IAP to help guide the incident response.

The Santos IAP process is built on the phases described in Figure 8-1.

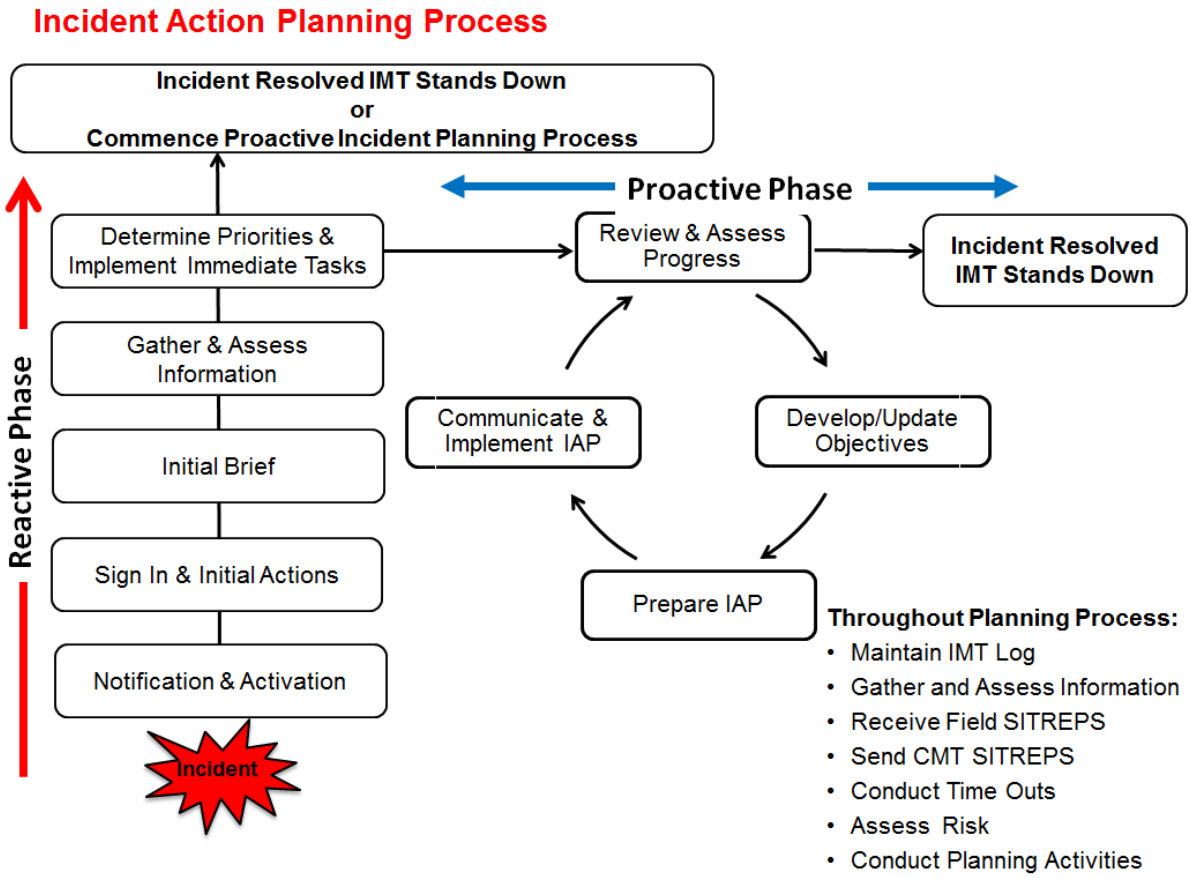

Figure 8-1: Incident action plan process

8.1 Reactive phase planning

The initial phase of the incident action planning process can be considered a reactive phase (indicatively lasting up to 48 hours) where information on the incident is being progressively established through reports coming in from the field. During this phase there is no formal Incident Action Plan to follow (given the incident has just begun and details are still being established) however the OPEP (this document) has been prepared to contain all first strike oil spill response actions required to be followed during this phase in lieu of a formal IAP.

First strike response actions are summarised in Initial Response, Table 2-1 at the beginning of this document and provide links to relevant oil spill strategy sections within the OPEP which contain a more detailed list of implementation actions and considerations as well as statements of performance (performances standards) that must be followed to ensure the initial response meets regulatory requirements and environmental performance outcomes.

For each credible oil spill scenario covered by this OPEP, the first-strike response actions have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic NEBA (also referred to as a SIMA). During the reactive phase the strategic NEBA is to be reviewed and, using the specific information gathered from the spill, operationalised into an operational NEBA. This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

8.2 Developing an incident action plan

At the end of the reactive phase where the incident specifics have been determined, a more formal phase of spill response is entered whereby a documented IAP is developed to guide the incident response activities for the next operational period. An operational period is defined as the period scheduled for execution of actions specified in the IAP. The next operational period is nominally a daily period but, for long running incidents, may be extended further where the pace of the incident response has settled, and the level of new information has decreased.

As IAPs and response strategies are implemented their performance is monitored. The performance measurement results are fed back into the IMT to provide the IMT with greater situational awareness to enable the effective formulation of following IAPs. Those response strategies that are effective are continued or increased, while those strategies that are ineffective are scaled back or ceased.

The performance against the objectives of the IAP must be documented in the Incident Log by the IMT. This provides the IMT with information required to assist in formulating the following IAP and provides evidence of Santos's response to the incident for regulatory and legal investigations that will follow the termination of the incident.

IAP performance is monitored through IMT communication with in-field response personnel both verbally and through logs/reports/photos sent throughout the response (e.g. surveillance personnel, beach masters, team leaders, laboratory chemists, etc.) who report on the effectiveness of the response strategies.

IAP forms and processes are documented in the Santos SharePoint Oil Spill Response Tile and in the SO ER Documentation SharePoint site. Access subfolders to display all forms required to conduct incident action planning. Each functional position within the IMT has subfolders carrying forms and processes unique to the functional position on the Oil Spill Tile.

8.3 Environmental Performance

Table 8-1 lists the environmental performance outcome, control measures, performance standards and measurement criteria for incident action planning.

Table 8-1: Environmental performance – incident action planning

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
Incident action planning	**Response Preparedness**		
	IMT Exercise and Training Plan	[EPS-RP-005] Incident action planning and NEBA is practiced by the IMT during exercises	Exercise records
	Response Implementation		
	Incident action plan	[EPS-RP-006] Incident action plan is completed for each operational period and approved by the Incident Commander	Incident Log Incident Action Plan/s

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards [EPS ID]**	**Measurement criteria**
		[EPS-RP-007] Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident Log Incident Action Plan/s
	NEBA	[EPS-RP-008] An operational NEBA will be undertaken for each operational period of the incident	NEBA Incident Action Plan
	IMT activation and de-escalation	[EPS-RP-009] IMT will be activated Immediately once notified of a level 2/3 spill (to Incident Commander).	Incident Action Plan
		[EPS-RP-010] The decision to de-escalate the IMT will be made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role.	NEBA Incident Action Plan
	Tactical Response Plans	[EPS-RP-011] If monitor and evaluate shows that shoreline contact of Protection Priority Areas is likely, TRPs will be developed or sought from other titleholders/ regional industries prior to shoreline contact.	TRP

9. Source Control

The initial and highest priority response to an oil spill incident following the health and safety of onsite personnel is to prevent or limit further loss of hydrocarbons to the environment.

For major hydrocarbon release incidents from DC pipelines, the Devil Creek Emergency Response Plan (DC-40-IF-00096) outlines the initial actions to be taken by onsite personnel to control the source of a hydrocarbon spill and limit the volume released to the environment.

For vessels with a Shipboard Oil Pollution Emergency Plan (SOPEP), the SOPEP will provide any relevant initial actions to control the source of the spill if the spill is from a vessel.

For the ongoing response to a loss of well control (LOWC) incident at Reindeer Platform, the Source Control Planning and Response Guideline (DR-00-OZ-20001) is to be consulted as the primary source of information for implementing a relief well response.

The sections below provide an outline of source control activities noting that the Devil Creek Emergency Response Plan (DC-40-IF-00096), Vessel SOPEP and Source Control Planning and Response Guideline (DR-00-OZ-20001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Level 1 Vessel and Platform Releases

Level 1 activations are based on spills which will not have an adverse effect on the public or the environment and can be controlled by the use of resources available onsite, without the need to mobilise additional resources for combatting the spill. Level 1 spills associated with this activity are considered credible from leaks and spills associated with hydrocarbon storage and handling on Reindeer platform and supply vessels. This scenario does not include loss of well control or export riser/pipeline releases covered in Sections 9.3 and 9.4, respectively, or vessel fuel tank rupture, covered in Section 9.2.

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for Level 1 vessel and platform releases. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. The implementation guide for vessel and platform releases is found in Section 9.1.1.

Table 9-1: Level 1: Vessel & Platform Releases – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine / onshore environment.			
Initiation Criteria	Notification of spill			
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**	**Hydraulic Oil**	**Lube Oil**
	✓	✓	✓	✓
Termination criterion	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbon.			

9.1.1 Implementation guidance

Implementation guidance is summarised in Table 9-2. In the event MDO is released from a vessel due to a tank rupture, the relevant vessel-specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident.

Table 9-2: Implementation guidance – vessel and platform releases

Action		Consideration	Responsibility	Complete
Initial Actions	In the event of a loss of production hydrocarbons from platform topside production equipment, consult the Devil Creek Emergency Response Plan (DC-40-IF-00096)	-	Offshore Platform Designated Person/ Facility Emergency Commander	❑
	For refuelling and chemical transfers between support vessels and between support vessels and offshore platforms, consult the Refuelling and Chemical Management Standard (SO-91-IQ-00098)	Notwithstanding vessel-specific procedures for source control, the following activities would be evaluated immediately for implementation, providing it is safe to do so: • For spills during pumping operations, pumping activity to cease immediately. • Isolation of damaged, leaking equipment. • Where drainage is open to the marine environment, drainage is to be isolated as soon as practicable following the spill to prevent discharge to the ocean (the Vessel Master or On-scene Commander will confirm that the drainage network is closed on the vessel before washing down the deck after excess oil has been cleaned up). • Use of onsite spill kit resources (i.e. sorbent material) to clean-up spills. • Recovery of dropped container where practicable, where containers of hydrocarbons are dropped during vessel to platform transfers. • Disposal of contaminated waste to licenced waste contractor. • Isolation and repair of damaged, leaking equipment.	Offshore Platform Designated Person/ Vessel Master/ Facility Emergency Commander	❑

9.2 Vessel collision - fuel tank rupture

Table 9-3 provides the environmental performance outcome, initiation criteria and termination criteria for source control response to a fuel tank rupture. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. The vessel tank rupture implementation guide is presented in Table 9-4.

Table 9-3: Source control (vessel collision) environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.
Initiation Criteria	Notification of incident/spill
Applicable hydrocarbons	MDO
Termination criterion	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons

Details of the worst-case spill scenario are described in Section 6.1.

9.2.1 Implementation guidance

Implementation guidance is summarised in Table 9-4. In the event of a vessel or platform release the relevant vessel-specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident.

Table 9-12 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this strategy.

Table 9-4: Implementation guidance – fuel tank rupture

Action		Consideration	Responsibility	Complete
Initial actions	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed as applicable	Notwithstanding vessel specific procedures for source control, the following activities would be immediately evaluated for implementation providing safe to do so: • Reduce the head of fuel by dropping or pumping the tank contents into an empty or slack tank. • Consider pumping water into the leaking tank to create a water cushion to prevent further fuel inventory loss. • If the affected tank is not easily identified, reduce the level of the fuel in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised. • Evaluate the transfer of fuel to other vessels. • Trim or lighten the vessel to avoid further damage to intact tanks. • Attempt repair and plugging of hole or rupture.	Vessel Master	❑

9.3 Loss of well control

A Reindeer condensate spill of up to a maximum of 4,029 m^3 is assessed as credible from a loss of well control at the Reindeer platform. Only the surface release is credible, refer to the EP for further justification (see also Table 6-1 & Table 6-2).

The Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038) identifies direct intervention, top-kill and relief well drilling as contingency strategies to respond to a loss of well control at Reindeer Platform wells.

The primary means of controlling a well that cannot be brought under control using onsite resources is the drilling of a relief well to intercept the well bore and kill the flow of hydrocarbons.

Table 9-5 provides the environmental performance outcome, initiation criteria and termination criteria for controlling the source of a loss of well control. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-5: Source control (loss of well control) environmental performance outcome, initiation criteria and termination criteria

Environmental Performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.
Initiation criteria	Loss of well control
Applicable hydrocarbons	Reindeer condensate
Termination criterion	The primary well is contained and killed to prevent any further release of hydrocarbon to the environment.

Details of the worst-case spill scenario details are described in Section 6.1. Source control methods are described in further detail in the following sections.

9.3.1 Emergency shutdown (ESD)

The Devil Creek Emergency Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate Reindeer platform ESD systems, where they are not already triggered automatically.

9.3.2 Hazard zone mapping

A major release of hydrocarbons sub-surface will result in a gas boil zone at the sea surface and is likely to create a hazardous atmosphere. In the event of a major release sub-surface or at the surface, hazard zone prediction modelling is done as part of the in-response oil spill modelling provided by RPS.

9.3.3 Relief well drilling

The risk of a loss of well control event is introduced during well intervention activities due to the requirement to breach and enter the pressure envelope of the well.

As per the Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038) controlling a loss of well control through the drilling of a relief well by a MODU, or through top-kill from the platform or vessel, are strategies that will be pursued if the well cannot be contained through ESD or direct intervention.

Relief well planning is required for Reindeer production wells in the event of relief well drilling. Relief well planning is conducted as per Santos Drilling & Completions Management Process. Findings from the planning will determine pumping/well-kill requirements for top-kill (if possible) and the technical design and MODU requirements for drilling a relief well.

Relief well drilling is the primary source control strategy to control a LOWC. The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

9.3.3.1 Surface / top well kill

Prior to the 2017 Reindeer RST logging campaign which involved well activities entering the pressure envelope of the well, and as such introduced the risk of a loss of well control, a top kill study was conducted to demonstrate the feasibility of this option. The top-kill study was conducted by third party subject matter expert Schlumberger.

For clarity, the top-kill scenario is modelled on a small uncontrolled leak to atmosphere at the production tree that cannot be isolated upstream that may still allow safe access to the platform and tie-in to the leaking well via existing infrastructure (i.e. connecting to the production tree via the kill wing outlet) and safe operation of a vessel located alongside the platform. It is estimated that this leak rate would be in the range of 400cc/min, small enough not to generate an explosive gas cloud and access to the platform is still preserved. This methodology would not be considered should safe access to the platform or ability to operate a vessel alongside the platform not be achievable.

A high-pressure pumping package would be deployed on a vessel, the vessel is moored alongside the platform, and a flexible high pressure kill line is deployed from the vessel to the platform. The simulation assessed the ability to bullhead the well dead from a shut-in gas to surface scenario, whilst out-running the surface leak and not exceeding the safe working pressure of the surface equipment.

The top-kill model utilised a leak rate of up to 10,000cc/min. (which is the lowest leak surface leak rate the modelling software allows) and demonstrated that utilising a minimum kill rate of 350gpm (~10bpm) the gas could be effectively bull-headed without excessive well bore pressures. A large range of reservoir injectivity values were assessed for both seawater and kill-weight mud with a maximum pump pressure of less than 3,000 psi. This is well within the capability of high-pressure pumping equipment (e.g. cement units/triplex pumps, high-pressure treating iron pipe-work and flexible high-pressure hoses) readily available within the region. The simulation is further documented in Reindeer Schlumberger Report 1-1BAORA3.

Santos has successfully planned and executed well kill/bull-heading/flushing operations during routing non-leaking well suspension activities on numerous platforms using this technique with local personnel and equipment.

9.3.3.2 Relief well planning

Relief well planning is embedded into the Santos Drilling and Completions Management Process (DCMP). The following industry accepted guidelines have been adopted to assist relief well planning requirements:

- SPE Technical Report: Calculation of Worst-Case Discharge Rev 1 2016 (SPE, 2016): This is used as part of the prospect screening review to generate a credible rate for oil spill modelling, as well as providing an input for the dynamic kill modelling as part of the Well Specific Source Control Plan.
- Offshore Energies UK (OEUK) Relief Well Planning for Offshore Wells Guideline, Issue 3, 2024 (OEUK, 2024): This methodology is used to confirm a well complexity analysis and tailor required content for the Well Specific Source Control Plan to the appropriate level of detail.

All wells associated with the Reindeer WHP are included in a well specific source control plan (SCP). The SCP is a Santos controlled document and is encompassed in the well management plan (WMP). The SCP will contain relief well planning information, specifically:

- MODU positioning assessment for relief well drilling locations
- relief well tangible equipment requirements and availability
- relief well trajectory analysis and casing design
- dynamic well kill hydraulic simulation results.

These reports are static reports developed prior to higher-risk campaign-specific activities. While the SCP contains planning information relevant to drilling a relief well for any well release (e.g. MODU positioning locations), time-variable information, such as MODU availability, can only be assessed at the specific time that they are needed.

To ensure Santos has current MODU availability, Santos maintains a register of MODU activity within the region and updates this on a monthly basis. The relief well rig capability register includes information about:

- MODU name
- MODU contract status (operator and contract duration)
- Current location
- Maximum water depth capability

- MODU type (floating vs jack-up; mooring type; rig design/class)
- Available drilling envelope
- BOP specifications
- BOP connector specifications
- Mud pumps specifications/capability
- Choke and kill line internal diameters
- Storage capability (i.e. MDO, base-oil, brine, drill-water, potable water, bulks)
- NOPSEMA/ DEMIRS safety case (yes/no)

The SCP includes a review of the most recent MODU capability register to identify the most suitable MODU for the well. In the event a suitable MODU is not in Australian waters, or is not predicted to be in Australian waters at the time of the activity, further work will be completed to identify a regionally suitable MODU, along with a mobilisation plan that demonstrates construction of a relief well within the time frame outlined in Table 9-6 is achievable. Once a MODU is allocated as a potential relief well MODU for a project, the MODU capability register will be annotated as such. As such, any change to the register on a month-to-month basis that affects a preferred MODU will trigger a revision to the SCP for that particular well. The review will be completed within 4 weeks of identifying the change.

In order to facilitate and expedite the use of a regional MODU for relief well drilling an Australian Petroleum Production and Exploration Association (APPEA) Memorandum of Understanding: Mutual Assistance is in place. This agreement provides the mechanism to facilitate the transfer of drilling units and well-site services between operators in Australian and Timor Leste administered waters in order to respond urgently to emergency source control events.

A Safety Case Revision will be required for the relief well rig to undertake the activity; this cannot be submitted before the event. The Safety Case Revision will be based on existing documents, specifically the Safety Case Revision approved for the drilling of the original well and the Safety Case in force for the relief well rig. A Safety Case Revision is to be submitted within 14 days from the well leak, however the critical path time allowed for the preparation of the document is three days. The remaining estimated time would be used for gathering post-event data, mobilising the workforce and conducting a hazard identification. It is not practicable to reduce the critical path days with additional pre-planning as document revision, final review and approval will still be required after completing the hazard identification.

9.3.3.3 Relief well schedule

The worst-case credible loss of well control volume is based on an initial discharge of approximately 173 MMscf/d of Gas with 677 STB/d of Condensate with a total of 6.5 BSCF of gas and 25,000 STB of condensate discharged over a period of 10 weeks. The well is then anticipated to cease flowing due to the low gas rates and high-water rates corresponding to high water gas ratios. In total the worst-case credible loss of well control volume with no restrictions on flow with exhaustion on reservoir pressure is based on 10 weeks (70 days).

An indicative relief well drilling schedule is provided in Table 9-6. This is based on control of a blow-out well by 13 weeks (91 days). This period is used as a base case well control timeframe by Santos based on indicative mobilisation durations, relief well planning and operations. It could take up to 47 days to have a MODU on location ready to spud. The base case well control timeframe for drilling a relief well across Santos' other wells is generally 77 days. The additional 14 days is required for this scope based on the planning assumption that a suitable jack-up MODU capable of drilling in shallow waters is unlikely to be available in Australian waters. As a result, additional time will be required to mobilise the MODU from international waters (i.e. Singapore) to the operational area. Long lead item equipment to enable a relief well to be drilled within the 91-day timeframe is currently held in the Santos inventory or has been confirmed to be available at short notice from vendors or other operators in the region.

This timeline has been assessed as ALARP based on the current controls/measures in place, however, Santos is actively working with industry to evaluate measures to improve on the ALARP response time model through the APPEA Drilling Industry Steering Committee Source Control Response Industry (SCRI) Working Group. The SCRI working group is an initiative established to drive collaboration and continuous improvement in source control emergency response planning. The working group will explore and act on opportunities to align and strengthen the Titleholders' source control emergency response capability through "mutual aid" initiatives and drive continuous improvement by implementing fit-for-purpose and effective source control emergency response strategies.

Table 9-6: Schedule for mobile offshore drilling unit arriving on location

Task	Duration (in days)	Controls
LOWC relief well		
• Event reported • Begin sourcing of rig for relief well drilling operations • Concurrently, stand up relief well drilling team and activate relief well specialists	2	• On-site communications • Active IMT on call including Operations Section Chief/Relief Well Team Lead • Stand-up relief well team (as per Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialist services contract (Wild Well Control) • Regional MODU tracking • APPEA MoU: Mutual Assistance
• Relief well MODU confirmed. Relief well MODU suspends operations and prepares to mobilise to relief well location. • Demobilisation of equipment from previous operator • Concurrently, prepare relief well MODU Safety Case Revision (SCR) and submit to NOPSEMA/DEMIRS • Concurrently, prepare relief well design and dynamic kill plan. Prepare relief Well Management Plan (WMP) and submit to NOPSEMA/DEMIRS	7	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Pre-completed well specific Source Control Plan complete with relief well study • Relief Well Drilling specialist services contract (Wild Well Control) • Regional MODU tracking • APPEA MoU: Mutual Assistance • Access relief well long lead equipment from inventory or other operators (e.g. casing and wellhead) • Drilling services contracted
• Contract relief well MODU • Concurrently, continue preparations for rig mobilisation • Concurrently, NOPSEMA/DEMIRS assessment of relief well MODU SCR and relief well WMP • Mobilise relief well MODU to location.	38	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialists services contract (Wild Well Control)
Total days prior to arrival, ready to spud/commence relief well operations	**47**	
Drill and construct relief well and complete dynamic well kill operations	44	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialist services contract (Wild Well Control)
Total days from LOWC to well kill	**91**	

9.3.4 Implementation guidance

Implementation guidance for source control (drilling of a relief well) is summarised in Table 9-7.

Table 9-7: Implementation guidance – loss of well control

Action		Responsibility	Complete
Initial Actions	**Relief well**		
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Relief Well Team Leader	❑
	Notify Santos Drilling and Completions Team to assemble a Source Control Branch and immediately begin preparations.	Relief Well Team Leader	❑
	Notify well control service provider personnel for mobilisation.	Relief Well Team Leader and Source Control Branch Director	❑
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MoU.	Source Control Branch Director	❑
	Refine, as necessary, the relief well pre-planned work described in this section to reflect the actual depths and asses the suitability of well locations.	Source Control Branch Director	❑
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief Section Chief	❑
	Deploy equipment and personnel to site to begin spud and drill.	Relief Well Team Leader	❑
Ongoing Actions	**Relief well**		
	Design Relief Well, using relief well pre-planning work	Source Control Branch Director	❑
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	❑
	Deploy equipment and personnel to site to begin operations.	IMT Drilling Team Leader	❑
	Monitor progress of relief well drilling and communicate to IMT.	IMT Drilling Team Leader	❑

9.4 Subsea Infrastructure Failure

Subsea infrastructure failure here includes the export riser and subsea pipeline to the shoreline. The worst-case credible spill is a release of 121.4 m^3 of Reindeer condensate from the subsea pipeline between the platform (Subsea isolation valve) and the shoreline. This includes pipeline within Commonwealth and State waters.

Table 9-8 provides the objective, initiation criteria and termination criteria for this tactic. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Refer to Table 9-9 for the implementation guide for subsea infrastructure failure.

Table 9-8: Subsea infrastructure failure – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Activation criteria	Notification of a spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓	**x**
Termination criterion	The oil cargo in the ruptured subsea export pipeline is secured and release to the marine environment stopped.	

Table 9-9: Subsea infrastructure failure– implementation guide

Pipeline Release				
Activation time	Immediately upon receiving notification of incident/ spill.			
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Consult The Devil Creek Emergency Response Plan (DC-40-IF-00096 to activate riser / pipeline emergency shut down [ESD]).	These following Major Incidents outlined within the DC ERP (DC-40-IF-00096) are applicable: DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline) RE- MAE #3 (Hydrocarbon Release from Riser and Pipeline close to Platform)	Emergency Commander	❑
	Where and when safe to do so, an inspection class remotely operated vehicle (ROV) and support vessel, will be mobilised to visually identify any subsea incident location.	-	Incident Commander/ Operations Team Leader	❑
Resources			**Location**	
Equipment	Inspection class ROV.		On vessels of opportunity Contracted at the time of incident.	
	Vessels		Santos operational sites Vessels of opportunity	
Personnel	Santos Facility Emergency Response Team members		Santos Operational sites	
Maintenance of response	The resources to activate the pipeline ESDs are always present within the Reindeer and DC control room. Additional response tactics that may be implemented following a pipeline release are discussed separately.			

9.4.1 Initial Response

The Devil Creek Emergency Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate riser/ pipeline ESD systems, where they are not already triggered automatically.

These following Major Incidents outlined within the DC ERP (DC-40-IF-00096) are applicable:

- DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)
- RE- MAE #3 (Hydrocarbon Release from Riser and Pipeline close to Platform)

Pipeline inventory will be minimised where possible through DCGP operations, to reduce the potential volume released to the marine environment.

9.4.2 Identification and Repair

Where and when safe to do so, an inspection class ROV and support vessel, will be mobilised to visually identify any subsea incident location, in addition to vessel and aerial surveillance conducted as per the Monitor and Evaluate Plan (Section 10).

Pipeline repair will involve the mobilisation of a repair team taking into consideration requirements as specified under the 16" DC Supply Pipeline Operational Safety Case and Pipeline Management Plan (RE-14-RF-00036.02). Santos maintains, in secure storage, certified spare 16" pipe and connectors suitable for a sectional replacement in localised damage scenarios.

9.5 Onshore pipeline release

Onshore pipeline failure includes the buried export pipeline (Reindeer 16" pipeline) between the shoreline and the boundary of the Devil Creek Gas Plant (DCGP). A conservative worst case credible spill is a release of 121.4 m^3 of Reindeer condensate. Gas will also be released leading to the potential for ignition and fire. This section covers the initial response to control the source of Reindeer condensate from an onshore pipeline release.

Table 9-10 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Refer to Table 9-11 for the implementation guide for an onshore pipeline release.

Table 9-10: Onshore pipeline release - objectives, initiation criteria and termination criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Activation criteria	Notification of spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓	X
Termination criterion	The cargo in the leaking or ruptured pipeline is secured and release to the onshore (terrestrial) environment is stopped.	

Table 9-11: Onshore pipeline release– implementation guide

Onshore Hydrocarbon Spill				
Activation time	Immediately upon receiving notification of incident/ spill.			
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Initial actions undertaken by site to control the release will be conducted as per the Devil Creek Emergency Response Plan (DC-40-IF-00096), specifically DC-Major Incident #8 (Hydrocarbon Release from the Import Pipeline)	Actions include activating Reindeer Platform remote ESD and reducing pipeline inventory through running of gas plant with wellhead valve closed.	Emergency Commander	❑
Resources			**Location**	
Personnel	Emergency Response Team		Devil Creek	

9.5.1 Initial Response

The Devil Creek Emergency Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate pipeline ESD systems, where they are not already triggered automatically. The following Major Incidents outlined within the DC ERP (DC-40-IF-00096) are applicable:

- DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)

9.5.2 Identification

For the buried onshore pipeline, a small leak from loss of integrity (corrosion) is more likely than a rupture from external impact. Where a small leak is below the limit of detection of automated ESD, identification of the leak may not occur until it is manually identified during routine pipeline ROW/easement surveillance.

The requirements and frequency of pipeline ROW/easement and surveillance for the buried onshore section of the Reindeer 16” pipeline is outlined within the Onshore Pipeline Inspection Procedure (OP-14-IG-00001). The surveillance is currently conducted every 6 months.

9.6 Environmental performance

Table 9-12 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 9-12: Environmental performance - source control

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Response Preparedness			
	Vessel Spill Response Plan (SOPEP/SMPEP)	[EPS-SC-001] Activity/support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine	Audit records. Inspection records

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Source control - vessel collision spill control		pollution emergency plan (SMPEP) that outlines procedures to combat spills	
		[EPS-SC-002] Spill exercises on activity/support vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close-out reports
Source control – relief well drilling	Source Control Planning and Response Guideline (DR-00-OZ-20001) provides guidance for well specific source control planning and response, and includes the Santos Source Control Emergency Response Plan in Section 7	[EPS-SC-022] The Source Control Planning and Response Guideline (DR 00 OZ 20001) is in place and up to date during the activity	Source Control Planning and Response Guideline (DR-00-OZ-20001)
	Well specific Source Control Plan developed prior to well intervention	[EPS-SC-023] A well specific Source Control Plan is in place prior to a well intervention taking place. Source control plan will identify suitable rig availability for relief well drilling.	Well specific Source Control Plan
	Contract and Equipment Access Agreement with WWCI	[EPS-SC-024] Contract and Equipment Access Agreement with WWCI are maintained providing technical support and equipment	Contract with WWC
	Relief Well Rig Capability Register is maintained during the activity to monitor MODUs potentially available for relief well drilling	[EPS-SC-026] Relief Well Rig Capability Register, to monitor rigs currently present in Australasia and record relevant details including rig specifications, contract status and safety case approvals, is maintained during the activity through monthly monitoring.	Relief Well Rig Capability Register
	Arrangements for source control emergency response personnel	[EPS-SC-025] Arrangements for access to source control personnel are maintained during the activity	Contract/MoUs for source control personnel
Source control – pipeline release	Devil Creek Emergency Response Plan	[EPS-SC-047] Current DC ERP (DC-40-IF-00096) in place covering incident response actions for pipeline hydrocarbon release	DC ERP (DC-40-IF-00096)
		[EPS-SC-048] MAE drills undertaken as per Incident Drills and Exercise Schedule (DC-40-IF-0098)	Facility Drill Schedule
Response Implementation			
Source control – vessel collision spill control	Vessel Spill Response Plan (SOPEP/SMPEP) implemented	[EPS-SC-003] Actions to control spill associated with a vessel incident followed in accordance with SOPEP or SMPEP.	Vessel logs
Source control – relief well drilling	Source Control Planning and response Guideline (DR-00-OZ-20001) provides guidance for well specific source control planning and response, and includes the Santos Source Control Emergency	[EPS-SC-028] Relief well drilling implemented in accordance with the Source Control Planning and Response Guideline (DR-00-OZ-20001) during a well release	Incident Log

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Response Plan in Section 7		
	Source Control Branch	[EPS-SC-029] Source Control Branch mobilised within 24 hours of being notified of the well release	Incident Log
	Well control specialists	[EPS-SC-031] Well control specialists mobilised within 72 hours of being notified of the well release	Incident Log
	Equipment/Services for relief well drilling	[EPS-SC-030] Equipment/Services for Relief Well drilling sourced within 5 days of the well release being identified	Incident Log
	Relief well MODU	[EPS-SC-032] MODU for relief well drilling to be onsite by Day 47 from the start of a well release.	Incident Log
	Relief well construction	[EPS-SC-033] Relief well completed within 91 days from start of well release	Incident Log
Source control – pipeline release	Devil Creek Emergency Response Plan	[EPS-SC-049] Actions to control loss of containment from pipeline release are in accordance with the DC ERP (DC-40-IF-00096)	Incident log

10. Monitor and evaluate

Understanding the behaviour and likely trajectory of an oil spill is critical to evaluate the appropriate response strategy. There are a number of methods that can be used to monitor and evaluate, including:

- vessel surveillance
- aerial surveillance
- tracking buoys
- oil spill trajectory modelling
- satellite imagery

The sections below outline the operational monitoring strategies considered applicable to worst case spill events identified for Reindeer and Devil Creek operational activities and cessation of production.

10.1 Vessel Surveillance

Table 10-1 lists the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-1: Vessel surveillance – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate methods in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by OSC)	
Applicable hydrocarbons	**MDO**	**Reindeer Condensate**
	✓	✓
Termination criterion	• Vessel-based surveillance is undertaken at scheduled intervals during daylight hours, and continues for 24 hours after the source is under control and a surface sheen is no longer observable, or • NEBA is no longer being achieved or • Agreement is reached with Jurisdictional Authorities to terminate the response.	

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea-state conditions or where fresh hydrocarbons at surface pose safety risks (e.g. gas/condensate).

10.1.1 Implementation guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities to be considered when selecting this strategy. Table 10-3 has a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to start initial vessel surveillance operations are listed in Table 10-4. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-21 lists the environmental performance standards and measurement criteria for all monitor and evaluate methods including this strategy.

Table 10-2: Implementation guidance – vessel surveillance

Action		Consideration	Responsibility	Complete
Initial actions	Notify nearest available support vessel to commence surveillance.	Current Santos on hire vessels or vessels of opportunity (VOO) can be used. Automatic Identification System (AIS) vessel tracking is available through Emergency Response (ER) intranet page.	On-Scene Commander Operations Section Chief	☐
	Source additional contracted vessels if required for assistance.	Refer to Santos Vessels for Oil Spill Response (7110-650-ERP-0001) for guidance on vessel availability monitoring and vessel types.	Logistics Section Chief	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms (Appendix E) and provide to On-Scene Commander (Level 1 spills) or IMT (Level 2-3 spills).	Photographic images are to be taken where possible and included with surveillance forms. Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	Vessel Observers	☐
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick) to the IMT within 60 minutes of completing vessel surveillance.	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms.	Vessel Master and/or On-Scene Commander	☐
Ongoing Actions	Review surveillance information to validate spill fate and trajectory.	-	Planning Section Chief/ GIS Team Leader	☐
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate.	-	Environment Unit Leader	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Surveillance data is useful in updating the Common Operating Picture	Planning Section Chief	☐

Table 10-3: Vessel surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Contracted vessels and vessels of opportunity	Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Availability dependent upon Santos and vessel contractor activities.	Vessels mobilised from Dampier, Varanus Island, Exmouth or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.

Table 10-4: Vessel surveillance – first strike response timeline

Task		Time from IMT call-out
IMT begins sourcing Santos-contracted vessel or VOO for on-water surveillance		<90 minutes
Santos-contracted vessel VOO onsite for surveillance		<24 hours (daylight dependent)
Minimum resource requirements		
One vessel. No specific vessel or crew requirements.		
Deployment Location	**Approximate Distance to Operational Area[21] (nautical miles)**	**Approx. steam time[22] (hours:mins)**
Exmouth	172 (318 km)	17:00
Dampier/Karratha	45 (83 km)	4:30
Varanus Island	56 (104 km)	5:45

10.2 Aerial surveillance

Table 10-5 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-5 Aerial surveillance – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of a Level 2/3 spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓1	✓1
Termination criterion	• Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, OR • As directed by the relevant Control Agency.	

Aerial surveillance is used to record the presence and size of the hydrocarbon spill at surface as well as other environmental observations including weather conditions, marine fauna and sensitive receptors in the area. Aerial surveillance provides superior coverage over vessel surveillance for estimating the spatial extent of a spill but is generally required only for larger Level 2/3 spills.

[21] *As measured to Reindeer WHP*

[22] *At average rate of 10 nautical miles per hour*

10.2.1 Implementation guidance

Table 10-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-7 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial surveillance operations are listed in Table 10-8. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Table 10-21 lists the environmental performance outcome, control measures, performance standards and measurement criteria for this strategy.

Table 10-6: Implementation guidance – aerial surveillance

Action		Consideration	Responsibility	Complete
Initial Actions	Contact contracted aviation provider- provide details of incident and request mobilisation to spill site for initial surveillance.	If aviation asset is available near spill location, use where possible to gather as much information about the spill. If aviation asset is not available at spill location IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met prior to deployment. There should be an attempt to obtain the following data during initial surveillance: • name of observer, date, time, aircraft type, speed and altitude of aircraft • location of slick or plume (global positioning system [GPS] positions, if possible) • spill source • size of the spill, including approximate length and width of the slick or plume • visual appearance of the slick (e.g. colour) • edge description (clear or blurred) • general description (windrows, patches etc.) • wildlife, habitat or other sensitive receptors observed • basic metocean conditions (e.g. sea state, wind, current) • photographic/video images.	Operations Section Chief Logistics Section Chief	❑
	Source available Santos Aerial Observers, arrange accommodation/logistics and deploy to Forward Operations/Air base location.	Santos Aerial Observer list available from First Strike Resources on Santos Offshore ER Intranet page.	Operations Section Chief Logistics Section Chief	❑
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation operations. Expected that two overpasses per day of the spill area are completed.	Flight plan to confirm with OSC that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Section Chief / Aviation Superintendent	❑
	Pre-flight briefing.	-	Aerial Observers Contracted aircraft provider/ pilots	❑
	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna.	Operations Section Chief	❑

Action		Consideration	Responsibility	Complete
	Determine the spill extent by completing Aerial Surveillance Log (Appendix F) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (Appendix G). Take still and/or video images of the slick.	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code (BAOAC).	Aerial Observer	❑
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (Appendix H).	Provide a copy of completed Record Sheets to Environment Unit Leader and OSM Implementation Lead.	Aerial Observer	❑
	Record shoreline habitat type and degree of oiling by completing the Aerial Surveillance Shoreline Observation Log (Appendix I).	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code (BAOAC).	Aerial Observer	❑
	Relay all surveillance records (logs, forms, photographic images, video footage) to the IMT	Where possible, a verbal report via radio/telephone en-route providing relevant information should be considered if the aircraft has long transits from the spill location to base	Aerial Observer Planning Section Chief Operations Section Chief	❑
Ongoing Actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Subplan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	Operations Section Chief/ Aviation Superintendent Planning Section Chief	❑
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities	-	Logistics Section Chief	❑
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider	-	Planning Section Chief GIS Team Leader	❑

Table 10-7: Aerial surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Rotary-wing aircraft and flight crew	• Santos contracted provider/s	• 2 x contracted (1 x primary + 1 x backup) • Additional as required	• Karratha	Activation of aerial surveillance using helicopter pilots will occur <3 hours of notification of the spill. Helicopter on site for surveillance <6 hours of the spill (daylight dependent).
Aerial surveillance Crew	• Santos aerial observers	• 7 x Santos staff	• Perth and Varanus Island (VI)	24 hours - available from Day 2 of the incident
	• AMOSC / Industry Mutual Aid	• 6 x AMOSC staff • 5 x AMOSC Core Group personnel available • Additional trained industry mutual aid personnel	• Australia wide	24 hours - available from Day 2 of the incident
Drones and pilots **secondary response to assist vessel-based surveillance	• AMOSC	• Drones available 24/7 through AMOSC sub-contract • 1 x pilot	• Fremantle	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12)
	• OSRL – Third-Party Unmanned Aerial Vehicle (UAV) provider	• 2 x qualified remote pilots, however response is on best endeavour	• Australia / international	Depending on the port of departure, one to two days if within Australia
	• Local WA hire companies	• 10+	• Perth and regional WA	

Table 10-8: Aerial surveillance – first strike response timeline

Task	Time from IMT call-out
Aircraft activated for aerial surveillance	<3 hours
Aircraft onsite for aerial surveillance	<6 hours (daylight dependent)
Trained Aerial Observers mobilised to airbase	<24-48 hours (from Day 2) (daylight dependent)
Minimum resource requirements	
• Santos contracted helicopter and pilots • Santos trained Aerial Observers	

Nearest Airport	Approximate Distance[23] (nm)	Approx. flight time[24] (hours: minutes)
Port Hedland	137 (253.7 Km)	1:10
Karratha	50 (92.6 Km)	0:25
Learmonth	180 (333.3 Km)	1:30

[23] *As measured to Reindeer WHP*

[24] *At average flight speed of 120 knots/hr*

10.3 Tracking buoys

Table 10-9 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-9: Tracking Buoys - environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of a Level 2 or 3 spill May be deployed in a Level-1 spill if deemed beneficial by the OSC	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓1	✓1
Termination criterion	• Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable, OR • As directed by the relevant Control Agency or NEBA.	

10.3.1 Implementation guidance

Table 10-10 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 10-11 provides a list of resources that may be used to implement this strategy.

Table 10-12 provides a summary of AMOSC equipment mobilisation timeframes. Mobilisation times for the minimum resources that are required to commence implementation of this tactic are listed in Table 10-13. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Table 10-9 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-10: Implementation guidance - tracking buoys

Action		Consideration	Responsibility	Complete
Initial Actions	Organise vessel to mobilise two tracking buoys from Varanus Island	Personnel and vessel safety is priority. Current Santos on hire vessels or VOOs can be used. AIS vessel tracking is available through ER intranet page.	OSC/Operations Section Chief	❑
	Deploy two tracking buoys at leading edge of slick.	Note deployment details and weather conditions in incident log.	Vessel Master	❑
	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys.	Refer login details of tracking buoy monitoring website on Santos ER intranet site.	OSC Planning Section Chief/GIS Team Leader	❑
	Use tracking buoy data to maintain Common Operating Picture.	Data tracked online.	Planning Section Chief/ GIS Team Leader	❑
	Relay information to spill fate modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief/ GIS Team Leader	❑
Ongoing Actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	Incident Action Plan to provide guidance regarding any additional deployments of tracking buoys.	Planning Section Chief	❑
	Mobilise additional tracking buoys if required from other Santos operations (Santos presently has 10 Tracker Buoys located on the North West Shelf) and an additional 8 from AMOSC stockpiles.	-	Logistics Section Chief	❑
	Direct the deployment of the Tracker Buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction.	-	Operations Section Chief	❑
	Organise vessel to deploy additional tracking buoys if required.	For continuous releases over multiple days use a rolling deployment/collection of tracking buoys to provide better coverage of plume direction.	Operations Section Chief	❑
	Deploy tracking buoys.	-	Vessel Master	❑
	Monitor movement of tracking buoys.	-	Planning Section Chief/GIS Team Leader	❑
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief/GIS Team Leader	❑

Table 10-11: Tracking buoy resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Tracking buoys	Santos	4	Varanus Island	VI/Dampier buoys <12 hours pending vessel availability
		2	Exmouth	Exmouth buoys 24 to 48 hours pending vessel availability
		4	Dampier	Additional buoys available from Dampier if required
AMOSC tracking buoys	AMOSC	4	Fremantle	Response via duty officer within 15 minutes of first call-AMOSC personnel available <1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12).
		4	Geelong	

Table 10-12: Australian Marine Oil Spill Centre equipment mobilisation timeframes (road freight)

	Perth	Darwin	Exmouth	Dampier	Broome
Geelong	40 hours / 3,395 km	44 hours / 3730 km	64 hours / 4,520 km	70 hours / 4,840 km	68 hours / 4,970 km
Perth	NA	48 hours / 4,040 km	15 hours / 1,250 km	19 hours / 1,530 km	27 hours / 2,240 km
Exmouth	15 hours / 1,250 km	38 hours / 3,170 km	NA	7 hours / 555 km	16 hours / 1,370 km
Broome	27 hours / 2,240 km	22 hours / 1,870 km	16 hours / 1,370 km	11 hours / 855 km	NA

Table 10-13: Tracking buoy – first-strike response timeline

Task	Time from IMT call-out
Two tracking buoys deployed from Varanus Island, Exmouth or Dampier using vessels of opportunity.	<24 hours
Minimum Resource Requirements	
• Two tracking buoys for initial deployment (Varanus Island, Exmouth or Dampier depending on the spill scenario)	

10.4 Oil spill trajectory modelling

Table 10-14 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this strategy.

Table 10-14: Oil spill trajectory modelling - environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of Level 2 or 3 spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓1	✓1
Termination criterion	• Spill fate modelling will continue for 24 hours after the source is under control and surface sheens, or in-situ hydrocarbons are no longer detectable, or until no longer beneficial to predict spill trajectory and concentrations, OR • As directed by the relevant Control Agency.	

Oil spill trajectory modelling uses computer modelling (e.g. OILMAP, SIMAP) to estimate the movement, fate and weathering potential of spills. Santos has engaged RPS Group to provide forecast spill fate modelling. RPS Group use SIMAP and OILMAP modelling systems that comply with Australian Standards (ASTM Standard F2067: Standard Practice for Development and Use of Oil Spill Models). RPS Group also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

A particular advantage of spill trajectory modelling is that the transport and weathering of spilled hydrocarbons can be forecast, at all times of the day and night, at any location, and under any type of metocean conditions. By contrast, aerial surveillance and vessel-based monitoring will be constrained to daytime use, and have limits imposed by the operating environment. Aerial surveillance and vessel-based monitoring are, however, essential for model validation, verification and calibration of any modelling or first principal predictions.

10.4.1 Implementation guidance

Table 10-15 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 10-16 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required for oil spill modelling are listed Table 10-17. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-15: Implementation guidance - oil spill trajectory modelling

Action		Consideration	Responsibility	Complete
Initial Actions	Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos ER SharePoint). Request for three-day forecast trajectory modelling.	-	Environment Unit Leader	❑
	Determine requirement for gas/VOC modelling and request initiation.	Hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil, especially at close proximity to release site.	Safety Officer Environment Unit Leader	❑
	Operational surveillance data (aerial, vessel, tracker buoys) to be given to modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy.	-	Planning Section Chief/GIS Team Leader	❑
	Login to the RPS Group data sharing website and maintain connection. Download modelling results.	Data should be stored digitally and backed up on to independent digital storage media. All datasets should be accompanied by a metadata summary and documented quality assurance and control procedures.	Planning Section Chief/GIS Team Leader	❑
	Place RPS Group modelling data into GIS/Common Operating Picture.	RPS Group is to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly.	Planning Section Chief/GIS Team Leader	❑
	If chemical dispersants are considered applicable strategy for spill scenario, request modelling provider to model how dispersant addition effects the distribution and concentration of floating oil, subsea oil and shoreline loading.	Planning and Operations to provide inputs for modelled simulation based on potential/planned dispersant operations. Outputs from dispersant addition modelling to inform NEBA.	Planning Section Chief Operations Section Chief	❑
	Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct NEBA on proposed response strategies.	-	Environment Unit Leader	❑
Ongoing Actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture.	-	Planning Section Chief/ GIS Team Leader	❑
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy.	-	Planning Section Chief/ GIS Team Leader	❑

Table 10-16: Oil spill trajectory modelling resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
RPS OST modellers and software	RPS Group under direct contract to Santos, also available through AMOSC	Daily OSTM reports	Perth – digital	2-4 hours from activation

Table 10-17: Oil spill trajectory modelling – first strike response timeline

Task	Time from IMT call-out
RPS OSTM activated by IMT	<2 hours
OSTM provided to IMT	<4 hours
Minimum Resource Requirements	
• Contracted OST modellers and software • OSTM Activation Form	

10.5 Satellite Imagery

Table 10-18 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-18: Satellite Imagery - environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓	✓1
Termination criterion	• Satellite monitoring will continue until no further benefit is achieved from continuing; or as advised by relevant Control Agency.	

Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT.

Suitable imagery may be available satellite imagery suppliers. This can be done through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar (SAR) and visible imagery may both be of value. Availability of satellite images for a specific location will be dependent on several factors including satellite current position, satellite availability/tasking and weather conditions (cloud cover obscures images).

10.5.1 Implementation guidance

Table 10-19 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-20 provides a list of resources that may be used to implement this strategy. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. Table 10-21 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-19: Satellite imagery implementation guide

Action		Consideration	Responsibility	Complete
Initial Actions	Assess requirement for satellite imagery.	-	Planning Section Chief	❑
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery.	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required.	Planning Section Chief	❑
	Assess suitability and order imagery.	-	Planning Section Chief	❑
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation.	-	GIS Team Leader Planning Section Chief	❑
Ongoing Actions	Review satellite imagery to validate spill fate and trajectory.	-	Planning Section Chief	❑
	Use satellite imagery to periodically reassess the spill and modify the response (through the IAP), as required.	Use surveillance data when updating the Common Operating Picture.	Planning Section Chief	❑

Table 10-20: Satellite imagery resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Satellite Imagery	KSAT – activated through AMOSC MDA – activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	If satellite images are required, Santos to notify provider within 12 hours.

10.6 Environmental performance

Table 10-21 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 10-21: Environmental performance - monitor and evaluate

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID}**	**Measurement criteria**
Monitor and Evaluate - vessel and aerial surveillance	**Response Preparedness**		
	Maintenance of MSAs with multiple vessel providers for surveillance vessel capability	[EPS-ME-001] Santos maintains MSAs with multiple vessel providers as specified in Table 10-3	MSAs with vessel providers
	Minimum specifications list for surveillance vessels	[EPS-ME-002] Maintain minimum specifications list for surveillance vessels to aid in rapid vessel selection	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Track location of potential surveillance vessels	[EPS-ME-003] Santos maintains access to Automatic Identification System (AIS) Vessel Monitoring System to track	AIS live tracking portal

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID}**	**Measurement criteria**
		potential surveillance vessel locations.	
	Master Services Agreement (MSA) with aviation supplier for aerial surveillance capability	[EPS-ME-009] MSA in place with helicopter/aircraft provider throughout activity	MSA with aviation suppliers
	Trained aerial observers available through Santos personnel	[EPS-ME-010] Santos maintains a pool of trained aerial observers	Exercise Records Training Records
	Trained aerial observers available through mutual aid arrangements facilitated by AMOSC	[EPS-ME-011] Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Access to certified UAV providers	[EPS-ME-012] Maintenance of contract for access to UAV providers	List of certified UAV providers AMOSC Participating Member contract OSRL Associate Member contract
	Aircraft charter companies for fauna observations	[EPS-ME-013] Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers
	Response Implementation		
	Vessel Surveillance First Strike capability mobilised	[EPS-ME-004] First strike is mobilised in accordance with details and timings as specified in Table 10-4	Incident log
	Vessel surveillance daily observation reports	[EPS-ME-007] Daily observation reports submitted to IMT until termination criteria is met	Incident log
	Vessels and chartered surveillance aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	[EPS-ME-006] Vessels comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	Vessel contractor procedures align with Santos' Protected *Marine Fauna Interaction and Sighting Procedure;* Completed vessel statement of conformance
		[EPS-ME-014] Chartered surveillance aircraft comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91- 11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity	Aircraft contractor procedures align with Santos' Protected *Marine Fauna Interaction and Sighting Procedure*

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID}**	**Measurement criteria**
		Conservation Regulations 2000 which includes controls for minimising interaction with marine fauna	
	Aerial Surveillance First strike capability mobilised	[EPS-ME-015] First strike is mobilised in accordance with details and timings as specified in Table 10-8.	Incident log
	Aerial surveillance – two passes per day	[EPS-ME-016] Following initiation of aerial surveillance, two passes per day of spill area by observation aircraft provided	Incident log IAP
	Aerial surveillance trained aerial observers	[EPS-ME-017] Trained Aerial Observers mobilised to airbase (Darwin) within 24 hours supplied from day 2 of response (daylight dependent)	Incident log
	Aerial surveillance flight schedules	[EPS-ME-019] Flight schedules are maintained throughout response	IAP
	Aerial surveillance observer log	[EPS-ME-020] Observers completed aerial surveillance observer log following completion of flight	Completed Aerial Surveillance Observer Logs
Monitor and evaluate – tracking buoys	**Response Preparedness**		
	Tracking buoys available	[EPS-ME-023] Maintenance of 10 tracker buoys throughout the activity	Computer tracking software Tracking buoy tests
	Response Implementation		
	Tracking buoy first strike capability mobilised	[EPS-ME-024] First strike is mobilised in accordance with details and timings as specified in Table 10-13	Incident log
Monitor and evaluate – oil spill modelling	**Response Preparedness**		
	Maintenance of contract for emergency response modelling	[EPS-ME-027] Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract
	Maintenance of access to additional emergency response modelling	[EPS-ME-028] Access to additional spill modelling capability to ensure redundancy	Membership in place with OSRL
	Response Implementation		
	Oil spill modelling provider first contact	[EPS-ME-029] Oil Spill Modelling provider will be contacted within 2 hours upon notification of a Level 2 or 3 spill	Incident Log

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID}**	**Measurement criteria**
	Oil spill modelling provider output minimum timings	[EPS-ME-030] Modelling delivered to IMT within 2 hours of request to service provider	Incident Log
Monitor and evaluate – satellite imagery	**Response Preparedness**		
	Satellite imagery and analysis capability	[EPS-ME-032] Satellite imagery and analysis accessed through third party provider activated through AMOSC and/or OSRL	AMOSC Participating Member contract, OSRL Associate Member contract
	Response Implementation		
	Satellite imagery and analysis provided to IMT	[EPS-ME-033] Data incorporated into Common Operating Picture and provided to spill modelling provider	Incident Log IAP

11. Mechanical dispersion

Table 11-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 11-1: Mechanical dispersion - environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion and biodegradation	
Initiation criteria	Monitor and evaluate data identifies thin oil patches at sea surface that are not naturally dissipating in sea surface and is posing risks to wildlife and shorelines by remaining on the surface	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓2	✓2
Termination criterion	• There is no longer a noticeable reduction of surface oil resulting from the activity, or • NEBA is no longer being achieved, or • Unacceptable safety risks associated with gas and VOCs at the sea surface, or • Agreement is reached with Jurisdictional Authorities to terminate the response	

11.1 Overview

This response strategy assists with the natural dispersion process; creating mixing through physical agitation by using a vessel's propellers and wake, which encourages the oil to break into smaller particle sizes that are more easily biodegraded. The two common activities associated with mechanical dispersion are:

- manoeuvring a vessel through the slick, using propeller wash and vessel wake to create mixing in the water body
- spraying water from the fire hose of a vessel and moving the vessel through the water body to create additional mixing and breakup of the slick.

11.2 Implementation guidance

Table 11-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 11-3 provides a list of resources that may be used to implement this strategy. The OSC/Vessel Master and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 11-2: Implementation guidance – mechanical dispersion

Action		Consideration	Responsibility	Complete
Initial Actions	The Operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations.	Water depth, sea state. Possible impacts to sensitive shorelines and/or wildlife. Before spill naturally disperses. This activity is to be conducted during daylight hours only and requires a safety plan to be developed prior to implementation.	Operations Section Chief Environment Unit Leader Planning Section Chief	❑
	Safety Officer to develop a safety plan for the activity with respect to potentially dangerous gases and VOCs (including applicable controls).	Ambient gas testing during condensate spills providing safe levels for operation of personnel and vessels	Operations Section Chief Safety Officer	❑
	Notify vessel-based responders to trial mechanical dispersion.	-	Operations Section Chief	❑
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Section Chief for inclusion in Operational NEBA.	-	Vessel Master/s Santos AMOSC Core Group Responders	❑

Table 11-3: Mechanical dispersion resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Vessels undertaking other activities Vessel(s) can be specifically contracted for the strategy if required (refer to Santos Vessel Requirements for Oil Spill Response document [7710-650-ERP-0001])	Santos contracted vessel providers	Availability dependent upon Santos and vessel contractor activities	Vessels mobilised from Exmouth, Dampier, and NW locations. Locations verified through AIS Vessel Tracking Software.	Varies subject to location and availability

11.3 Environmental performance

Table 11-4 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 11-4: Environmental performance – mechanical dispersion

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion		
Response strategy	**Control measures**	**Performance standard [EPS ID]**	**Measurement criteria**
Mechanical dispersion	**Response preparedness**		
	Mechanical dispersion capability in place	[EPS-MD-001] Mechanical dispersion capability in place based on Santos contracted vessels availability	Existing MSAs with multiple vessel providers
	Response Implementation		
	Mechanical dispersion procedures in place to ensure safe and effective execution	[EPS-MD-002] Mechanical Dispersion to be conducted as per the Mechanical Dispersion Plan.	Mechanical Dispersion Plan; IAP; Incident Log
	Operational NEBA to determine net environmental benefit	[EPS-MD-003] Operational NEBA confirms suitability and environmental benefit.	Incident Log; IAP

12. Shoreline protection and deflection plan

Table 12-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 12-1: Shoreline protection and deflection – objectives, initiation criteria and termination criteria

Environmental performance outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities areas.	
Initiation criteria	• Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted, and • Approval has been obtained from the relevant Control Agency) to initiate response strategy	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓ 2	✓ 2
Termination criterion	• NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s, or • Agreement is reached with Jurisdictional Authorities to terminate the response strategy	

12.1 Overview

Protection and deflection tactics are utilised to divert hydrocarbons away from sensitive shoreline receptors and are more effective if they are deployed ahead of spill contact. They are typically used to protect smaller, high priority sections of shoreline.

The effectiveness of this response will be dependent on spill characteristics, hydrocarbon type, and the operating environment. Deployment is subject to constraints such as the potential grounding of vessels.

Protection and deflection is part of an integrated nearshore/ shoreline response to be managed by the relevant Control Agency where Santos is not the Control Agency (refer to Table 4-2), it will undertake first-strike protection and deflection activities as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline protection. Santos will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer North West Shelf OSM-BIP (7715-650-ERP-0002).

In the event of a spill with the potential for shoreline contact where Santos is not the Control Agency, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by the relevant Control Agency and therefore may differ from that included below.

Information gathered during monitor and evaluate activities and operational monitoring including shoreline assessments and assessed through an Operational NEBA will guide the selection of protection and deflection locations and techniques.

Shoreline protection and deflection techniques include:

- nearshore booming, which can involve different booming arrangements including:
  - exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
  - diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
  - deflection booming: booms deflect the spill away from an area requiring protection.
- berms, dams and dykes – uses sandbags or embankments to exclude oil from sensitive areas
- shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up)
- passive recovery – uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline
- non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, currents/tides and wind conditions and the available resources.

12.2 Implementation guidance

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 12-3 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial protection and deflection operations, unless directed otherwise by the relevant Control Agency, are listed in Table 12-4. The Incident Commander of the Control Agency's IMT (once they assume control) is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 12-2: Implementation guidance – shoreline protection and deflection

Action		Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to the relevant Control Agency have been made.	Refer to Section 7 for reporting requirements.	Planning Section Chief	❑
	Collect and provide monitor and evaluate information, operational monitoring data and existing sensitivity information/mapping to Control Agency for confirmation of priority protection areas and NEBA.	-	Environment Unit Leader Planning Section Chief	❑
	Actions below are indicative only and are at the final determination of the relevant Control Agency.			
	Conduct Operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline clean-up assessments North West Shelf OSM-BIP (7715-650-ERP-0002)	TRPs exist for the Dampier Archipelago Priority Protection Area. TRPs are available on the Santos ER Intranet page [25].	Environment Unit Leader	❑
	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area.	Shoreline Protection Plan may include: • priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations) • locations to deploy protection and deflection equipment • permits required (if applicable) • protection and deflection tactics to be employed for each location • list of resources (personnel and equipment) required • logistical arrangements (e.g. staging areas, accommodation, transport of personnel) • timeframes to undertake deployment • access locations from land or sea • frequency of equipment inspections and maintenance (noting tidal cycles) • waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes • no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first)	Operations Section Chief Planning Section Chief Environment Unit Leader	❑

[25] *Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA.*

Action		Consideration	Responsibility	Complete
		• shift rotation requirements.		
	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency.	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines.	Operations Section Chief Logistics Section Chief	❑
	Deploy shoreline protection response teams to each shoreline location selected and implement response.	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation prior to hydrocarbon contact.	Operations Section Chief On-Scene Commander	❑
Ongoing Actions	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities.	-	Environment Unit Leader	❑
	Report to the Operations Section Chief on the effectiveness of the tactics employed.	-	Shoreline Response Programme Manager – AMOSC core group responder	❑
	Response teams to conduct daily inspections and maintenance of equipment.	Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of Control Agency. Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers.	Shoreline Response Programme Manager	❑

Table 12-3: Shoreline protection and deflection – resource capability

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
Santos owned nearshore boom/skimming equipment	Santos	Beach Guardian (25 m lengths) Total – 6	Varanus Island – 4 Exmouth – 2	Within 72 hours for deployment by vessel from Varanus Island
		Zoom Boom (25 m lengths) Total – 13	Varanus Island – 8 Exmouth – 5	
		Desmi DBD16 brush skimmer Total – 2	Exmouth – 1 Varanus Island – 1	
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Total – 5	Karratha – 5	
		Structureflex inflatable Total – 25	Karratha – 10 Fremantle – 15	

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
		Versatech zoom inflatable Total – 18	Karratha – 5 Fremantle – 13	Access to National Plan equipment[26] through AMOSC[27] Equipment mobilisation times vary according to stockpile location
		Slickbar – solid buoyancy Total – 2	Karratha – 2	
		Structureflex – solid buoyancy Total – 13	Karratha – 3 Fremantle – 10	
		Structureflex – land sea Total – 60	Karratha – 30 Fremantle – 30 other locations around Australia	
		LWS 500 weir skimmer Total – 8	Fremantle – 4 Karratha – 4	
		Desmi termite skimmer Total – 2	Fremantle – 1 Karratha – 1	
		LAMOR 15 Ton Disc Skimmer Total – 4	Karratha – 4	
		LAMOR 50 Ton Wier Skimmer Total – 2	Darwin – 1 Karratha -2	
AMOSC nearshore boom and skimming equipment	AMOSC	Beach Guardian Shoreseal boom (25 m lengths) Total – 89	Broome – 4 Exmouth – 20 Fremantle – 19 Geelong – 46	Response via duty officer within 15 minutes of first call; AMOSC personnel available within one hour of initial activation call. Equipment logistics varies according to stockpile location For mobilisation timeframes refer to Table 12-4
		Zoom Boom (25 m lengths) Total – 185	Broome – 6 Exmouth – 19 Fremantle – 34 Geelong – 126	
		Lamor HDB 1300 Boom (200 m) on reel	Broome – 2	

[26] *Updated AMSA Equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal - https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[27] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
		Total – 2		
		Lamor HDB 1500 Boom (100 m) on reel Total – 3	Fremantle – 1 Geelong – 2	
		Lamor SFB-18 GP Solid Flotation Curtain Boom (30 m lengths) Total – 58	Fremantle – 18 Geelong – 40	
		Minimax 12 brush skimmer Total – 5	Broome – 1 Exmouth – 1 Fremantle – 2 Geelong – 1	
		Komara 12k disc skimmer Total – 4	Exmouth – 1 Fremantle – 1 Geelong – 2	
		Komara 20k disc skimmer Total – 1	Fremantle – 1	
		Komara 30k disc skimmer Total – 2	Geelong – 2	
		Passive weir skimmer Total – 3	Exmouth – 1 Fremantle – 1 Geelong – 1	
		Ro-vac vacuum skimmer Total – 4	Exmouth – 1 Geelong – 3	
		Desmi GT 185 brush/weir skimmer Total – 2	Exmouth – 1 Geelong – 1	
		Desmi Ro-mop 240 oil mop skimmer Total – 2	Exmouth – 1 Geelong – 1	
		Desmi Ro-mop 260 oil mop skimmer Total – 2	Fremantle – 1 Geelong – 1	
		Skimmer-Lamor Rock Cleaner-Brush Total – 4	Fremantle – 2 Geelong – 2	

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
		Skimmer-Lamor LWS500-Brush/Weir skimmer Total – 6	Fremantle – 3 Geelong – 3	
		Desmi 250 weir skimmer Total – 1	Geelong – 1	
		Canadyne Multi Head-Brush/Disc/Drum Total – 1	Geelong – 1	
		Versatech Multi Head-Brush/Disc/Drum Total – 1	Geelong – 1	
		Egmopol barge with brush skimmer Total – 1	Geelong – 1	
Industry Mutual Aid nearshore boom and skimming equipment	Facilitated by AMOSC	Nearshore boom and skimmers	WA/NT	Access to Industry Mutual Aid through AMOSPlan and facilitated by AMOSC
OSRL nearshore boom/skimming equipment (Note: further booms are available; the listed items are shown as an example). Guaranteed access to 50% of stockpile by equipment type. Access to more than 50% on a case-by-case basis.	OSRL	Air-skirt boom 10 m: 228 Air-skirt boom 20 m: 658 Air-skirt boom 200 m: 4 Beach sealing boom 10 m: 154 Beach sealing boom 15 m: 65 Beach sealing boom 20 m: 113 Inshore recovery skimmers: 126 Range of ancillaries to support above equipment	OSRL global stockpiles at base locations: UK Singapore Bahrain Fort Lauderdale	Response from OSRL Duty Manager within 10 minutes. Equipment logistics varies according to stockpile location.
Personnel (field responders) for OSR strategies	AMOSC Staff	Total – 12	Fremantle – 3 Geelong – 9	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	Total – 16	Perth/NW Australia facilities – 14 Port Bonython (South Australia – 2	From 24 hours <48 hours to WA locations
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility location across Australia	Location dependent. Confirmed at time of activation

Table 12-4: Shoreline protection and deflection – first strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirm if protection of shoreline sensitivity/s is required and begins sourcing resources	<4 hours
Santos Offshore Core Group mobilised to deployment port location	<24 hours
Protection booming equipment mobilised to deployment port location	<24 hours
Waste storage equipment mobilised to deployment port location	<24 hours
Boom deployment vessel mobilised to deployment port location	<24 hours
AMOSC Staff and Industry Core Group mobilised to deployment port location	<24-48hours
Protection/deflection operation deployed to protection location	<60-72 hours (weather/daylight dependent)
Minimum Resource Requirements	
Note: Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and DoT and have been developed for various NWS locations and are available on the Santos ER Intranet page; TRPs exist for the Dampier Archipelago Priority Protection Area, further described in Section 6.6.3 [28].Indicative first strike resources for a single site protection area are: • One small vessel suitable for boom deployment • Shoreline (e.g. Beach Guardian) and nearshore booms (e.g. Zoom Boom) plus ancillary equipment (e.g. anchors, stakes) sufficient for protection of shoreline resource • One skimmer appropriate for oil type • Waste storage equipment • One Protection and Deflection Team • Personal protective equipment	

12.3 Worst-case resourcing requirements

Protection and deflection resourcing requirements have been determined from stochastic modelling for affected shorelines. Table 12-5 presents all receptors contacted at ≥100 g/m² using the stochastic modelling results for scenarios 3, 5 and 6 presented in Section 6.3.1 (Scenarios 1, 2 and 5 did not predict any shoreline contact ≥100 g/m^2). It also presents planning considerations and estimated number of protection and deflection teams required for the different scenarios.

It should be noted that not all of the receptors listed in Table 12-5 will be contacted by each spill. These results are presenting the range of possible worst-case timeframes to contact and length contacted based on all runs that make up the stochastic model for each spill. Santos will use initial monitor and evaluate data (e.g. trajectory modelling, aerial surveillance) and operational monitoring data (i.e. feedback from SCAT operations) to determine where resources should be allocated. This may include directing resources to conduct protection and deflection at locations not identified as protection priority areas.

Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and DoT and have been developed for all of the PPAs (refer to Section 6.6.3).

Table 12-5: Resource requirements for shoreline protection and deflection for all locations contacted >100 g/m^2 based on stochastic results for all scenarios

Location	Min. arrival time shoreline oil accumulation ≥100 g/m² (days, hours)	Max. length of shoreline oiled (km) ≥100 g/m² in the worst simulation	Estimated No. of required protection and deflection teams to set up and monitor (and remarks)
Scenario 3 – subsea pipeline leak of Reindeer condensate near the HDD crossing (121.4 m^3)			
Northern Islands Coast	3 hours	3	1 team (comprises mainland locations and small islands with sensitive receptors; keep response personnel to minimum to reduce

[28] *Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA*

Location	Min. arrival time shoreline oil accumulation ≥100 g/m² (days, hours)	Max. length of shoreline oiled (km) ≥100 g/m² in the worst simulation	Estimated No. of required protection and deflection teams to set up and monitor (and remarks)
			disturbance of surrounding habitat and fauna)
Total estimated Protection and Deflection Teams required			**1 team**
Scenario 5 – MDO spill resulting from a vessel collision at the CSB (325 m³)			
Dampier Archipelago	2 days, 10 hours	5	2 teams (Archipelago of small islands with sensitive receptors; keep response personnel to minimum to reduce disturbance of surrounding habitat and fauna)
Barrow Island	14 days, 7 hours	1	1 team (island with sensitive receptors; keep response personnel to minimum to reduce disturbance of surrounding habitat and fauna)
Lowendal Islands	5 days, 13 hours	2	1 team (island chain with strong tidal currents present between islands that could affect success of anchoring)
Montebello Islands	5 days, 19 hours	3	2 teams (island chain with strong tidal currents present between islands that could affect success of anchoring)
Total estimated Protection and Deflection Teams required			**6 teams**
Scenario 6 – MDO spill resulting from a vessel collision at the HDD Crossing (325 m³)			
Dampier Archipelago	4 days, 19 hours	3	1 team (small island with sensitive receptors; keep response personnel to minimum to reduce disturbance of surrounding habitat and fauna)
Northern Islands Coast	2 hours	11	3 teams (comprises mainland locations and small islands with sensitive receptors; keep response personnel to minimum to reduce disturbance of surrounding habitat and fauna)
Total estimated Protection and Deflection Teams required			**4 teams**

Source: Modelling results as per RPS (2024)

A typical shoreline protection and deflection team would consist of 12 personnel as a minimum, comprised of the following:

- 1 x Incident Commander/Site Supervisor
- 1 x Shallow draft vessel skipper
- 1 x Shallow draft vessel deck-hand
- 9 x Protection and deflection operatives.

The resourcing requirements will be determined based on feedback from SCAT activities, on operational NEBA, and in consultation with DoT as the Control Agency. Shoreline effort will likely consist of a combination of protection and deflection and clean-up, with resources often working together and/or in parallel.

12.4 Environmental performance

Table 12-6 indicates the environmental performance outcomes, controls and performance standards for the Protection and Deflection response strategy.

Table 12-6: Environmental performance outcomes – protection and deflection

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response Preparedness**		
	Access to Santos protection and deflection equipment and personnel	[EPS-PD-001] Santos personnel and equipment stored and maintained / available as per Table 12-3	Santos oil spill response team database; Santos equipment register, Exercise reports
	Access to protection and deflection equipment and personnel	[EPS-PD-002] Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity as per Table 12-3	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG Arrangements
	Protection and deflection small vessel providers for nearshore booming operations are identified	[EPS-PD-004] Maintenance of a list of small vessel providers operating in the North West Region that could be used for nearshore booming	List of small vessel providers
	Response Implementation		
	First strike capability mobilised	[EPS-PD-005] First strike is mobilised in accordance with details and timings as specified in Table 12-4 unless directed otherwise by the Control Agency	Incident log
	IMT and Control Agency to agree protection priorities	[EPS-PD-007] Santos IMT to confirm protection priorities in consultation with Control Agency	IAP; Incident log
	Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	[EPS-PD-008] Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing. Operational NEBA to be undertaken each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination	Operational NEBA; Incident log; IAP
	IAP Protection and Deflection Sub-plan is developed to ensure effective execution and environmental impacts from response are minimised	[EPS-PD-006] IAP Shoreline Protection and Deflection Sub-plan including shoreline/nearshore habitat/bathymetry assessment and waste management is developed to provide oversight and management of shoreline protection and deflection operation, prior to shoreline protection and deflection operations commencing	Incident log; IAP Shoreline Protection and Deflection Sub-plan
	Use of shallow draft vessels for shoreline and nearshore operations	[EPS-PD-009] Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency	Vessel specifications documented in IAP

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Conduct shoreline/nearshore habitat/bathymetry assessment	[EPS-PD-010] Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment will be conducted prior to nearshore activities.	IAP records; Assessment records

13. Shoreline clean-up plan

Table 13-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 13-1: Shoreline clean-up – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.	
Initiation criteria	• Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted • NEBA indicates shoreline clean-up will benefit receptors • Approval has been obtained from Control Agency to initiate response strategy	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓2	✓2
Termination criterion	• As directed by DoT	

13.1 Overview

Clean-up of shorelines may be required for a worst-case spill of MDO and to a lesser extent a spill of Reindeer condensate. Both types of hydrocarbons are light and volatile with a very low proportion of residue following weathering. These hydrocarbons are difficult to handle for removal given their light nature but are readily washed from sediments by wave and tidal flushing. Contaminated sand and debris are the likely waste products from a shoreline response.

Shoreline clean-up aims to remove hydrocarbons from shorelines and intertidal habitat to achieve a net environmental benefit. Removal of these hydrocarbons helps reduce remobilisation of hydrocarbons and contamination of wildlife, habitat and other sensitive receptors. Shoreline clean-up is often a lengthy and cyclical process, requiring regular shoreline clean-up assessments (Refer to North West Shelf OSM-BIP [7715-650-ERP-0002]) to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by Control Agency. Where Santos is not the Control Agency (refer to Table 4-2) it will undertake first-strike actions as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline clean-up. The information obtained from monitoring and evaluation tactics (Section 10), and operational monitoring (Section 16), will be used by the IMT in the development of the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA.

Shoreline clean-up techniques include:

- Shoreline clean-up assessment – uses assessment processes (refer to North West Shelf OSM-BIP (7715-650-ERP-0002) to assess shoreline character, assess shoreline oiling and develop recommendations for response. Typically, this should be the first step in any shoreline clean-up response.
- Natural recovery – oiled shorelines are left untreated, and the oil naturally degrades over time.
- Manual and mechanical removal – removes oil and contaminated materials using machinery, hand tools, or a combination of both.
- Washing, flooding and flushing – uses water, steam, or sand to flush oil from impacted shoreline areas.
- Sediment reworking and surf washing – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

13.2 Implementation guidance

Table 13-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 13-3 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial shoreline clean-up operations, unless directed otherwise by the relevant Control Agency, are listed in Table 13-4. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-2: Implementation Guidance – shoreline clean-up

Action		Consideration	Responsibility	Complete
Initial Actions	**Actions below are indicative only and are at the final determination of the Control Agency.**			
	Initiate Shoreline Clean-up Assessment (if not already activated).	• Refer to North-West Shelf OSM-BIP (7715-650-ERP-0002) for additional information. • Unmanned Aerial Vehicles (UAVs) may be necessary for some sensitive environments and where personnel safety is at risk (e.g. dangerous fauna in remote locations).	Environment Unit Leader	❑
	Using results from Shoreline Clean-up Assessment, conduct Operational NEBA to assess shoreline clean-up suitability and recommended tactics for each shoreline location.	• Shoreline Clean-up Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. • The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision-making. • Engage a Heritage Adviser if spill response activities overlap with potential areas of cultural significance.	Environment Unit Leader	❑
	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP,	Shoreline Clean-up Plan may include (but not be limited to): • clean-up objectives • clean-up end points (may be derived from Shoreline Clean-up Assessment) • clean-up priorities (may be derived from Shoreline Clean-up Assessment) • assessment and location of staging areas and worksites (including health and safety constraints, zoning) • utility resource assessment and support (to be conducted if activity is of significant size in comparison to the size of the coastal community) • permits required (if applicable) • chain of command for onsite personnel • list of resources (personnel, equipment, personal protective equipment) required for selected clean-up tactics at each site • details of accommodation and transport management • security management • waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes	Environment Unit Leader Planning Section Chief Operations Section Chief	❑

Action		Consideration	Responsibility	Complete
		• establish no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first). • Shift rotation requirements. Refer to IPIECA guide: A Guide to Oiled Shoreline Clean-up Techniques (IPIECA-IOGP 2016c) for additional guidance on shoreline clean-up planning and implementation.		
	In consultation with the Control Agency procure and mobilise resources to a designated port location for deployment, or directly to location via road transport.	-	Logistics Section Chief Supply Unit Leader Deputy Logistics Officer (DoT IMT)	❑
	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency.	Each clean-up team to be led by a Shoreline Response Team Lead, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team. Clean-up teams and equipment will be deployed and positioned as per those observations by the Shoreline Clean-up Assessment Teams in consultation with the Control Agency. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.	Operations Section Chief Logistics Section Chief Deputy Logistics Officer (DoT IMT)	❑
Ongoing Actions	Shoreline Response Team Lead shall communicate daily reports to the IMT Operations Section Chief to inform of effectiveness of existing tactics and any proposed tactics and required resources.	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline Clean-up Assessment and clean-up, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end points have been met.	Shoreline Response Team Leader Operations Section Chief	
	The IMT Operations Section Chief shall work with the Planning Section Chief to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through the Supply and Logistics Section Chiefs.	-	Operations Section Chief Planning Section Chief Supply Unit Leader Logistics Section Chief	❑
	Monitor progress of clean-up efforts and report to the Control Agency.	-	Operations Section Chief On-Scene Commander Deputy OSC (Control Agency FOB)	❑

Table 13-3: Shoreline clean-up – resource capability

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
Manual clean-up tools (shovels, rakes, wheelbarrows, bags, etc.)	AMOSC shoreline kits	Boom Accessories – Beach Guardian Deployment Kit Total – 14	Fremantle – 2 Geelong – 8 Broome – 1 Exmouth - 3	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; equipment logistics varies according to stockpile location (Table 13-4)
	Santos	Shoreline clean-up container	Varanus Island – 1	Within 48 hours for deployment from Varanus Island
	Hardware suppliers	As available	Karratha / Exmouth / Perth	-
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit 3” Total – 2	Fremantle –1 Geelong – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 13-4
		Shoreline flushing kit 4” Total – 1	Geelong -1	
		Shoreline impact lance kit Total – 1	Geelong – 1	
Nearshore booms/ skimmers	AMOSC AMSA Industry mutual aid	Refer to Protection and Deflection (Table 12-3)	-	-
Decontamination/staging site equipment	AMOSC	Decontamination-kit (PPE) Total – 3	Broome – 1 Exmouth – 1 Geelong -1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 13-4
		Decontamination kit Locker Total – 3	Exmouth – 1 Fremantle – 1 Geelong – 1	
		Decontamination – vehicle washdown trailer Total – 2	Fremantle – 1 Geelong – 1	
		Decontamination – Decon. Support trailer Total – 1	Geelong – 1	

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
	AMSA	Decontamination station Total – 4	Karratha –2 Fremantle – 2	Access to National Plan[29] equipment through AMOSC[30] Equipment mobilisation times vary according to stockpile location.
	Oil spill equipment provider (e.g. Global Spill., PPS)	As available	Perth	Subject to availability
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks (9,000 L and 3,000 L) Total – 8	Geelong – 4 Fremantle – 2 Exmouth – 2	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see Table 13-4
		Vikotank (13,000 L) Total – 2	Broome – 1 Geelong – 1	
		Lamor (11,400 L) Total – 4	Fremantle – 4	
		IBCs (1 m^3) Total – 18	Geelong – 18	
	AMSA temporary storage	Fast tanks – (10 m^3) Total – 22	Darwin – 2 Karratha – 2 Fremantle – 4 Adelaide – 1 Brisbane – 2 Devonport – 2 Melbourne – 1 Sydney – 4 Townsville – 4	Access to National Plan equipment through AMOSC. Equipment mobilisation times vary according to stockpile location.
		Structureflex – (10 m^3) Total – 3	Brisbane – 1 Adelaide – 2	
		Vikoma – (10 m^3)	Darwin – 1	

[29] *Updated AMSA Equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal - https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[30] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
		Total – 20	Adelaide – 1 Brisbane – 1 Devonport – 2 Fremantle – 4 Fremantle – 3 Melbourne – 2 Sydney – 2 Townsville – 4	
	Santos Waste Management Service Provider	Refer to Waste management (Section 17)	Perth, Karratha	<24 hours
Personnel (field responders) for OSR strategies	AMOSC Staff	Total – 12	Fremantle – 3 Geelong – 9	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	Total – 16	Perth/NW Australia facilities – 14 Port Bonython (South Australia) – 2	12+ hours <48 to WA locations
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility location across Australia	Location dependent. Confirmed at time of activation
	Santos contracted Work Force Hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)

Table 13-4: Shoreline clean-up – first strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirms applicability of strategy and begins sourcing resources.	<4 hours
Santos Offshore Core Group mobilised to deployment port location.	<24 hours
Clean-up equipment mobilised to deployment port location.	24-48 hours
Waste storage equipment mobilised to deployment port location.	<24 hours
Remote island transfer vessel (if required) mobilised to deployment port location.	<24 hours
AMOSC Staff, Industry Core Group and Labour Hire mobilised to site/deployment port location.	<48 hours
Clean-up operation deployed to clean-up area under advice from Shoreline Assessment Team.	<60-72 hours (weather/daylight dependent)
Minimum Resource Requirements	
Resource requirements for shoreline clean-up will be situation/receptor specific. TRPs if developed for the area/receptor will outline suggested resource requirements and shoreline assessments (as part of operational monitoring) will be conducted prior to clean-up to confirm techniques. TRPs are held by Santos and DoT[31]. For further description on relevant TRPs for this activity, refer to Section 6.6.3.Indicative minimum requirements for one Santos-activated shoreline clean-up team are: • manual clean-up/shoreline flushing equipment kit • waste storage (bags, temporary storage tanks, skips as appropriate) • decontamination/staging equipment kit • personal protective equipment. One clean-up team comprises: • one Team Leader (AMOSC staff, Industry Core Group or Santos Core Group) • 10[32] shoreline clean-up responders (AMOSC Core Group, Santos contracted labour hire personnel).	

13.3 Shoreline clean-up resources

Shoreline clean-up equipment available for use by Santos is a combination of Santos owned, AMOSC, AMSA, DoT and OSRL equipment as well as other operator resources available through the AMOSPlan mutual aid arrangements. Shoreline consumables are available through hardware, PPE and specialist oil/chemical spill suppliers and mobile plant is available through hire outlets in Broome, Perth, Karratha and other regional centres. Where vessel deployments are required, Santos will leverage from existing contracted vessel providers in the first instance, and if required will source vessels from vendors that Santos already has a master service agreement with, or spot hiring vessels as needed. The Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) contains the specification for various types of vessels that may be required in an oil spill response, including vessels for shoreline clean-up support.

Shoreline clean-up personnel available to Santos is a combination of AMOSC Staff, Core Group Responders (comprising AMOSC trained Santos and Industry personnel), OSRL responders, State Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos's labour hire arrangements.

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Deployment will be under the direction of the relevant Control Agency and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline clean-up assessments (Refer to North West Shelf OSM-BIP [7715-650-ERP-0002]) will provide information to guide the clean-up strategy and deployment of resources.

[31] Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA.

[32] Remote islands and ecologically sensitive locations will have reduced personnel numbers to reduce impacts from clean-up operations (Refer to Section 6.6)

13.4 Worst-case resourcing requirements

Resourcing requirements for shoreline clean-up operations have been conservatively determined based on a manual clean-up rate of 1 m³ of oily waste per person per day. A bulking factor of 10 has been applied to manual clean-up activities (IPIECA-IOGP 2016b).

Santos has used stochastic modelling data for shoreline contact to plan for the worst-case shoreline clean-up requirements. Table 13-5 presents all receptors (protection priorities and other locations predicted to be contacted) contacted at ≥100 g/m² using the stochastic modelling results for scenarios 3, 5 and 6 presented in Section 6.3.1 (Scenarios 1, 2 and 5 did not predict any shoreline contact ≥100 g/m^2). For planning purposes, it also presents the estimated number of shoreline clean-up teams required for the different scenarios and planning considerations. Santos will also use an operational NEBA to assess the suitability of the number of shoreline clean-up teams required.

It should be noted that not all of the receptors listed in Table 13-5 will be contacted by each spill. These results are presenting the range of possible worst-case timeframes to contact and peak volume of oil ashore based on all runs that make up the stochastic model for each spill. Santos will use initial monitor and evaluate data and operational monitoring data (e.g. SCAT) to determine where resources should be allocated. This may include directing resources to conduct shoreline clean-up at locations not identified as protection priority areas.

Table 13-5: Resource requirements for shoreline clean-up for all locations contacted ≥100 g/m² based on stochastic results for all scenarios

Location	Min. arrival time shoreline oil accumulation ≥100 g/m² (days, hours)	Peak volume ashore (m³)	Potential max. waste generated (m³) – bulking factor of 10[33]	No. shoreline clean-up teams recommended (max 6 personnel / team)	Planning considerations
Scenario 3 – Subsea pipeline leak of Reindeer condensate near the HDD crossing (121.4 m3)					Small islands with sensitive receptors; keep response personnel to minimum to reduce disturbance of surrounding habitat and fauna. For key turtle nesting beaches and peak nesting periods for PPAs refer to Table 15-3 For key turtle nesting beaches on the Muiron Islands see Rob *et al.* (2019). Barrow Island: • Varied access • Chevron facilities present on eastern side of island Lowendal Islands: • Varied access • Santos facilities present on Varanus Island Montebello Islands • Numerous small islands with limited access • Strong currents present through channels Northern Islands Coast • Varied access • Remote shorelines and saltmarshes Dampier Archipelago • Facilities present at Dampier on mainland • Cultural heritage sites on numerous small islands
Northern Islands Coast	3 hours	8	80	2	
Total estimated Shoreline Clean-up Teams required				**2 teams**	
Scenario 5 – MDO spill resulting from a vessel collision at the CSB (325 m3)					
Dampier Archipelago	2 days, 10 hours	24	240	3	
Barrow Island	14 days, 7 hours	5	50	1	
Lowendal Islands	5 days, 13 hours	8	80	1	
Montebello Islands	5 days, 19 hours	8	80	1	
Total estimated Shoreline Clean-up Teams required				**6 teams**	
Scenario 6 – MDO spill resulting from a vessel collision at the HDD Crossing (325 m³)					
Dampier Archipelago	4 days, 19 hours	9	90	2	
Northern Islands Coast	2 hours	199	1,990	7	
Total estimated Shoreline Clean-up Teams required				**9 teams**	

Source: Modelling data – RPS (2024)

[33] *Bulking factor of 10 is for conservative planning purposes only. Reindeer condensate and MDO have low persistent residual fractions (<1% for Reindeer Condensate and <10% MDO) and asphaltene content and are therefore unlikely to emulsify and bulk to this extent.*

13.4.1 Operational and environmental considerations affecting resourcing

Tidal ranges in the EMBA and Scientific Monitoring Planning Area can range up to 4 m. Close to Barrow Island, Lowendal Islands and Montebello Islands the shallow bathymetry results in large areas of exposed seabed at low tide and strong currents persist close to the Islands (Chevron Australia 2014). In addition, much of the coastline is remote and inaccessible via road, making many shoreline clean-up techniques difficult and their use may result in greater environmental impacts. In addition, the remote nature, potential presence of dangerous fauna (i.e. saltwater crocodiles and Irukandji jellyfish) present significant safety risks to responders working in these environments.

Large scale operations involving large numbers of personnel may cause adverse environmental impacts at many of these sensitive shoreline locations. The constant removal of oil, even via manual removal can result in the removal of substrate (e.g. sand, pebbles). If intrusive clean-up is conducted frequently, over a long period of time and along contiguous lengths of coastline, this may result in geomorphological changes to the shoreline profile and adverse impacts to shoreline invertebrate communities which provide an array of ecosystem services (Michel *et al.* 2017).

Given the safety constraints and ecological sensitivities of these shorelines, shoreline clean-up operations should be conducted by smaller teams for a longer period of time. Intermittent manual treatment (<20 visits/month) and use of passive recovery booms is likely to be more effective than intrusive methods (e.g. intrusive manual removal >20 visits/month). Although this may take longer to undertake the clean-up, it is considered that the benefits outweigh the impacts as smaller teams are more targeted, recovering more oil and less sand and debris, reducing trampling of oil into the shore profile and minimising ecological impacts on the shorelines and their sensitive species.

The number of shoreline clean-up teams recommended to treat these shorelines is not based on extensive, intrusive and contiguous removal of oil and waste along all shorelines, but rather use of smaller teams and at lower frequency of visits. Where shoreline based manual removal is safe and deemed advantageous by shoreline clean-up assessment teams and the operational NEBA, this should be conducted via land access (if possible) or via suitable vessels. However, it should be noted that it is generally not feasible to move response equipment into and out of mangroves, tidal flats and delta environments without causing excessive damage. Even foot traffic must be minimised, either by laying down wooden walkways or relying on vessel-based activities as much as possible (API 2020). Santos has considered the access limitations, safety issues and number of clean-up teams that may be able to operate in each of these environments. A summary of these findings is presented below.

MDO and Reindeer Condensate are light products and although shoreline clean-up resources are planned for, not all the hydrocarbons may need to be removed (or be able to be removed) as they will continue to weather rapidly after beaching and is likely to disperse naturally.

13.4.2 Remote island deployment

The islands in the EMBA and Scientific Monitoring Planning Area are a mixture of large islands, such as Barrow Island, and smaller uninhabited islands, including Muiron Islands. For shoreline clean-up of remote islands, the following process could be implemented so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines. If shoreline contact is predicted with locations where TRPs exist, the TRP will be used to plan the deployment. Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, and WAMOPRA.

Vessels are to be mobilised to the designated deployment port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in four stages:

6. Drop off six-person clean-up containers (contents list in Appendix J) to shoreline contact locations defined by IMT through observation data; or if locations are too sensitive to be used as staging sites, then transfer equipment via landing barge for offsite staging.
7. Deploy marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary impacts to flora and fauna by the clean-up teams.
8. Deploy clean-up teams in six person squads with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary storage areas lined with damp-proof coarse (DPC) grade HDPE sheeting above the high-tide mark.
9. Deploy waste pickup landing barges to retrieve collected wastes from the temporary storage areas and to complete the shoreline clean-up and final polishing.

Multiple six-person teams are to be used based on the actual volume of oil deposited, which will be determined via shoreline clean-up assessments (North West Shelf OSM-BIP [7715-650-ERP-0002]). These teams can be resourced through the existing Santos arrangements, using a combination of personnel from OSROs for trained shoreline clean-up team leader roles and labour hire companies for clean-up team member roles.

13.5 Shoreline clean-up decision guides

To assist with planning purposes, guidance for the selection of appropriate shoreline response strategies based on the type of shoreline sensitivities is provided within Appendix K.

Operational guidelines for shoreline response activities including worksite preparation, manual and mechanical oil removal and vessel access for remote shorelines are included in Appendix L.

The WA Incident Management Plan – Marine Oil Pollution (WA DoT, 2023) also provides guidance on shoreline clean-up techniques and termination criteria.

13.6 Environmental performance

Table 13-6 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for the shoreline clean-up response strategy.

Table 13-6: Environmental performance – shoreline clean-up

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and trained personnel	[EPS-SCU-001] Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG maintained throughout activity.	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG Arrangements
	Access to Santos shoreline clean-up personnel	[EPS-SCU-002] Santos personnel available as per Table 13-3	Santos oil spill response team database
	Access to vessels suitable for remote island transfers of equipment, personnel and waste	[EPS-SCU-005] MSAs with multiple vessel providers maintained throughout activity	MSAs with multiple vessel providers Vessel details show suitability
	Vessel requirements for offshore island shoreline clean-up operations are identified	[EPS-SCU-006] Maintenance of vessel specification for remote island shoreline clean-up operations	Vessel specifications within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Access to shoreline clean-up labour hire personnel	[EPS-SCU-003] Maintenance of contract with labour hire provider	Labour hire contract
	Onboarding procedure to access shoreline clean-up labour hire personnel	[EPS-SCU-004] Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Response Implementation		
	First strike capability mobilised	[EPS-SCU-007] First strike is mobilised in accordance with details and timings as specified in Table 13-4 unless directed otherwise by DoT	Incident log

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
	IMT and Control Agency to agree protection priorities	[EPS-SCU-012] Santos IMT to confirm protection priorities in consultation with the control agency	IAP; Incident Log
	Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit	[EPS-SCU-013] Records indicate operational NEBA completed prior to shoreline activities commencing. Operational NEBA to be undertaken each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination	Operational NEBA; Incident Log; IAP
	IAP Shoreline Clean-up Sub-plan is developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-015] IAP Shoreline Clean-up Sub-plan including waste management is developed to provide oversight and management of shoreline clean-up operation	Incident Log; IAP Shoreline Protection and Deflection Sub-plan
	Shoreline clean-up operations will be implemented under the direction of the Control Agency to ensure effective and coordinated execution	[EPS-SCU-008] Clean-up strategies will be implemented under the direction of the Control Agency. Santos will make resources available to the Control Agency.	Incident Log
	Santos AMOSC core group responders available to the Control Agency for shoreline clean-up positions.	[EPS-SCU-016] Santos will make available AMOSC Core Group responders, or other appropriately trained responders, for shoreline clean-up team positions to the Control Agency	Incident Log
	Equipment for shoreline clean-up made available to the Control Agency from Santos, AMOSC and OSRL stockpiles	[EPS-SCU-017] Santos will make available to the Control Agency equipment from AMOSC and OSRL stockpiles	Incident Log
	NEBA included in development of following operational period IAP	[EPS-SCU-014] Effectiveness of shoreline clean-up to be evaluated by Team Leaders and reported to IMT for inclusion in NEBA. NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP; Incident Log
	Access plans are developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-018] Access plans for shoreline operations will be developed. Unless directed otherwise by the Control Agency, Access plans will prioritise use of existing roads and tracks, establish demarcation zones to protect sensitive areas and select vehicles appropriate to conditions	IAP demonstrates requirement is met
	Soil profile assessment is undertaken prior to earthworks to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-020] Unless directed otherwise by the designated Control Agency, a soil profile assessment is conducted prior to earthworks	Soil Profile Assessment; IAP; Incident Log

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
	Pre-cleaning and inspection of equipment (quarantine) is undertaken to minimise environmental impacts from response on offshore islands	[EPS-SCU-021] Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands	Quarantine documentation; IAP; Incident Log
	If spill response activities overlap with potential areas of cultural significance, Heritage Adviser will be engaged	[EPS-SCU-022] In consultation with the Control Agency, engage a Heritage Advisor to provide advice on any sites of cultural significance that may be affected directly by the spill, or indirectly through implementation of spill response measures.	Documented in IAP; Incident Log
	Select forward staging areas in consultation with the Control Agency	[EPS-SCU-023] Any establishment of forward staging areas at shoreline areas done under direction or in consultation with the Control Agency	Incident Log; IAP
	Establish demarcation zones in sensitive areas	[EPS-SCU-024] Unless directed otherwise by the Control Agency, demarcation zones are mapped out in sensitive habitat areas for vehicle and personnel movement, considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat.	IAP demonstrates requirement is met
	Operational restrictions of vehicle and personnel movement are established to limit erosion and compaction	[EPS-SCU-019] Unless directed otherwise by the designated Control Agency, operational restrictions on movement of personnel and vehicles, including vehicle types and traffic volumes, are established to minimise impacts from erosion and compaction	IAP demonstrates requirement is met
	Stakeholder consultation for deployments in coastal areas	[EPS-SCU-025] Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas	Consultation records

14. Onshore response

There is the potential for a leak or rupture of the buried export pipeline (Reindeer 16" pipeline) between the shoreline and the boundary of the Devil Creek Gas Plant (DCGP). The worst-case credible spill is a release of 121.4 m^3 of Reindeer condensate. This represents the entire pipeline inventory and is considered a conservative volume given the significant length of pipeline grading away from the buried shoreline section to the WHP. As per HAZMAT, direct on-site recovery and clean-up of hazardous materials and infrastructure is the responsibility of the owner of the hazardous materials (Santos). Under the *Environmental Protection Act 1986*, DWER would issue a pollution notice to the owner of hazardous materials that are involved in an emergency situation, requiring clean-up. Remediation of contamination at the spill site will be required as per the *Contamination Sites Act 2003* and Contamination Sites Regulations 2006.

Table 14-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. The Emergency Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. The implementation guide for the onshore response plan is found in Table 14-2.

Table 14-1: Onshore Response Plan – objectives, initiation criteria and termination criteria

Environmental Performance Outcome	Assist DFES in the control of hazardous material Remediate the site as directed by the Jurisdictional Authority.	
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓	X
Termination criterion	The site has been cleaned and remediated to the satisfaction of DWER (and DBCA)	

Table 14-2: Onshore response implementation guide

Onshore Response				
Activation time	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)			
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Source control actions as per the Devil Creek Emergency Response Plan (DC-40-IF-00096).	-	Emergency Commander (Facility OIM)	❑
	Site will notify DFES as applicable as per the Devil Creek Emergency Response Plan (DC-40-IF-00096)	-	Emergency Commander (Facility OIM)	❑
	The Devil Creek Emergency Response Team will respond under the advice of DFES and the Emergency Commander, as per the Devil Creek Emergency Response Plan (DC-40-IF-00096)	-	Emergency Commander (Facility OIM)	❑
	In the event of an onshore spill with the potential for groundwater contamination DWER and relevant landowner will be contacted regarding the potential for interaction with groundwater bores and advice on any isolations of water supply required.	Landowners bordering the pipeline corridor and contact details are outlined within the Devil Creek Stakeholder Management Plan for the Gas Plant and Associated Facilities (DC-00-RG-00018)	IMT Incident Commander/ Government Relations/Media Advisor	❑
	Asist DFES with resources as required for initial HAZMAT response.	Pipeline is buried in permeable soils and hydrocarbon is highly volatile and non-persistent. Low likelihood of free pooling hydrocarbon and high risk of fire/ explosion. The following equipment/techniques may be applicable to remove oi/contamination at surface: • Oil absorbents (materials and sorbent pads/boom) to reduce spread of hydrocarbon. • Shore sealing and absorbent booms if contaminated surface water is present. • Pumping equipment to remove free hydrocarbons of contaminated water at surface.	Emergency Commander (Facility OIM) Operations Unit Leader	❑

Onshore Response				
Escalation and Ongoing Response Actions	Conduct remediation of soil and groundwater affected by hydrocarbon contamination. The relevant Jurisdictional Authority for remediation is DWER and relevant legislation being the Contaminated Sites Act and Contaminated Site Regulations.	Available remediation options to reduce source contamination include methods such as: • use of down-well sorbent materials • use of down-well and trench skimmers • single/dual-phase extraction • vacuum extraction • Thermal and chemical flushing treatments • Available remediation options to reduce the spread contamination include methods such as: • Bentonite slurry walls • Sheet pile walls • Permeable reactive barriers • Funnel and gate systems • Hydraulic containment systems	Santos Contaminated Sites Project Team	❑

Onshore Response		
Resources		**Location**
Equipment	ERT Trailer containing oil spill sorbents	DC Gas Plant
	Portable pumps and IBCs	DC Gas Plant
	Sorbent booms, shore-sealing boom, nearshore boom, skimmer, shoreline clean-up container, oil pumps (shovels, sorbents, wheel barrows, PPE)	Santos (Varanus Island/ Exmouth)
	Additional booms and oil pumping equipment	AMOSC (Exmouth/Fremantle)
	Vacuum trucks Waste skips/containers for transportation	Waste contractor – Karratha
Personnel	Emergency Response Team Members	Devil Creek
	Santos AMOSC Core Group Members	Santos operational sites
	DFES response personnel	Karratha VFRS Dampier VFRS Perth
	DWER pollution response team	Perth
	HAZMAT Emergency Advisory Team (HEAT)	Perth
	Waste contractor personnel	Karratha
Maintenance of response	Santos has equipment and personnel available to implement and maintain an onshore response at the DC facility. Santos has arrangements in place with service providers (e.g. AMSOC) that allows the response to be scaled and sustained beyond the limits of the equipment and personnel from the VI Hub if required.	

14.1 Initial response

Given the flammable/explosive nature of a release of condensate/gas from the onshore pipeline, initial response will be dictated by safety constraints and done under the direction of DFES as the designated Control Agency. The nature of the hydrocarbon is such that protection of safety and control of fire will be top priorities. Measures to control the spread of contamination (through soil and groundwater) will be under advice from DWER.

Given the onshore section of pipeline is buried to a depth of 1.2 m up to and beyond the boundary of the Devil Creek Gas Plant, there is an existing barrier to the rapid spread of condensate in the event of a rupture or leak. As described in Section 3.4 containment is expected to be within 200 m of the pipeline with resultant contamination of soil and groundwater within this zone of impact.

The greatest potential for surface expression of condensate through the movement of contaminated groundwater is at the area of saline flats approximately 2 km from the shoreline along the pipeline route) where the groundwater table is at its lowest. In times of inundation after heavy rain this area can pool with water. A spill in this section could contaminate surface water which could be responded to using sorbent materials applied at the surface. Sorbent materials are available at the DCGP or through AMOSC stockpiles stored for use in coastal response (AMOSC and Santos stocks). Equipment (HAZMAT trailers) for petroleum/chemical spills are also located at Karratha/Dampier DFES VFRS. Any surface water contamination in this area is not considered to be under tidal/marine influence and given the topography and proximity to waterways it is not expected that drainage of contaminated into defined waterways will occur.

14.2 Site remediation

The type of activities that may be required are varied and will be guided by an initial and Detailed Site Investigation (DSI) under the review of a Contaminated Sites Auditor registered with DWER. The DSI will typically involve collection of groundwater and soil samples and the development of a conceptual site model. On the basis of the DSI, remediation activities will be evaluated and outlined within an approved Remediation Action Plan (RAP).

14.3 Onshore response plan environmental performance

Table 14-3 indicates the Environmental performance outcome, control measures, performance standards and measurement criteria for the Onshore response strategy.

Table 14-3: Environmental performance outcomes, controls and performance standards for shoreline onshore response strategy

Environmental Performance Outcome	Assist DFES in the control of hazardous material Remediate the site as directed by the Jurisdictional Authority.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
Onshore Response	Onshore Response	[EPS-ON-005] Initial clean-up strategies will be implemented under the direction of DFES	Incident Log
		[EPS-ON-006] Santos will make available AMOSC Core Group Responders for onshore clean-up team positions to the Control Agency	Incident Log
		[EPS-ON-007] Santos will make available to the Control Agency equipment from Santos, AMOSC and OSRL stockpiles	Incident Log
		[EPS-ON-008] NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan.	IAP/Incident Log
		[EPS-ON-001] Onshore response continues until termination criteria is met, as outlined within the Onshore response Plan.	Onshore Response Plan

Environmental Performance Outcome	Assist DFES in the control of hazardous material Remediate the site as directed by the Jurisdictional Authority.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	Remediation	[EPS-ON-009] Undertake remediation and monitoring as required under Contaminated Sites Regulations 2003	Contaminated Sites records incl. Detailed Site Investigation (DSI) and Remedial Action Plan (RAP)

15. Oiled wildlife

The WA DoT is the Control Agency and DBCA is the Jurisdictional Authority and lead agency for oiled wildlife response within WA State waters, WA marine parks and Islands. Santos and AMSA are the Control Agencies for oiled wildlife response within Commonwealth waters from facility and vessel spills respectively.

Table 15-1 provides the environmental performance outcome, initiation and termination criteria for this strategy.

Table 15-1: Oiled wildlife response – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement tactics in accordance with the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.	
Initiation criteria	Monitor and evaluate information and/or operational monitoring data shows that wildlife is contacted or are predicted to be contacted by a spill	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓1	✓1
Termination criterion	• Oiling of wildlife has not been observed over a 48 hour period; and • Oiled wildlife have been successfully rehabilitated; and • Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response.	

15.1 Overview

The short-term effects of hydrocarbons on wildlife may be direct such as the external impacts from coating or internal effects from ingestion and inhalation. Oiled wildlife response (OWR) includes wildlife surveillance/reconnaissance, wildlife hazing, pre-emptive capture and the capture, cleaning, treatment, and rehabilitation of animals that have been oiled. In addition, it includes the collection, post-mortem examination, and disposal of deceased animals that are found in the vicinity of an oil spill or are reasonable suspected of have succumbed to the effects of oiling.

Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat, impacts to food sources, and impacts to reproduction. An assessment of such impacts is covered in Section 6.8 of the EP and post-spill via scientific monitoring (Section 16).

Table 15-2 provides guidance on the designated Control Agency and Jurisdictional Authority for OWR in State and Commonwealth waters. For a petroleum activity spill in Commonwealth and Territory waters, Santos acts as the Control Agency and will be responsible for the wildlife response. The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) will be referred to for guidance for coordinating an OWR when Santos is the Control Agency and for the OWR first-strike response, otherwise the relevant State OWR Plan will be referred to, as described below.

The key plan for OWR in WA is the Oiled Wildlife Response Plan (WAOWRP) (DBCA, 2022a). The WAOWRP establishes the framework for preparing and responding to potential or actual wildlife impacts during a spill and sets out the management arrangements for implementing an OWR in conjunction with the SHP-MEE (WA DoT 2024). It is the responsibility of DBCA to administer the WAOWRP under the direction of the DoT (Table 15-2**)**. The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) is consistent with and interfaces the WAOWRP and WA Oiled Wildlife Response Manual (WA OWR Manual) (DBCA, 2022b).

If a spill occurs in WA State waters or enters State waters, DBCA is the Jurisdictional Authority for wildlife, and for Level 2/3 spills, will also lead the oiled wildlife response under the control of the DoT. DBCA is the State Government agency responsible for administering the *Biodiversity Conservation Act (WA) 2016* (BC Act), which has provisions for authorising activities that affect wildlife.

For Level 1 spills, Santos will be the Control Agency, including for wildlife response. It is however also an expectation that for Level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until DBCA is activated as the lead agency for wildlife response and formal handover occurs. Following formal handover, Santos will function as a support organisation for the OWR and will be expected to continue to provide planning and resources as required.

Table 15-2: Jurisdictional and control agencies for oiled wildlife response

Jurisdictional boundary	Spill source	Jurisdictional Authority for OWR	Control agency		Relevant Documentation
			Level 1	Level 2/3	
Commonwealth waters (3 to 200 nautical miles from territorial/state sea baseline)	Vessel	DCCEEW	AMSA		Western Australian Oiled Wildlife Response Plan (WAOWRP) Western Australia Oiled Wildlife Response Manual Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
	Petroleum activities		Titleholder		
Western Australian (WA) state waters (State waters to 3 nautical miles and some areas around offshore atolls and islands)	Vessel	DBCA	WA DoT[34]		
	Petroleum activities		Titleholder	WA DoT	

15.2 Wildlife priority protection areas

For planning purposes, determination of wildlife priority protection areas is based on stochastic modelling of the worst-case spill scenarios, the known presence of wildlife, and in consideration of the following:

- presence of high densities of wildlife, threatened species, and/or endemic species with high site fidelity
- greatest probability and level of contact from floating oil and/or shoreline accumulation
- shortest timeframe to contact

The wildlife priority protection areas for Reindeer and Devil Creek operations are outlined in Table 15-3 and align with the priority protection sites for spill response described in Section 6.6. Onshore environmental sensitivities at the DCGP site and priorities for protection are given in Section 6.6.2.

Depending on the timing of a potential hydrocarbon spill, certain species could be more impacted because of key seasonal biological activities such as breeding, mating, nesting hatching or migrating. Table 15-4 provides further detail of key wildlife activities in the Pilbara/Kimberley regions and the corresponding time of year.

Table 15-3: Wildlife priority protection areas (summary information based on EPs [EA-60-RI-00186 and EA-60-RI-10003])

Wildlife priority protection area	Key locations / fauna type	Reason
Northern Islands Coast	Turtles, birds and marine mammals	• Turtle nesting and breeding sites in many of the islands in this region. • Seabird nesting, including pelican (*Pelecanus sp.*), wedge-tailed shearwater (*Puffinus pacificus*) and pied cormorant (*Phalacrocorax varius*). • Seagrass beds surrounding many small islands, including Regnard Islands, likely to support foraging dugongs (*Dugong dugon*).
Dampier Archipelago	Turtles: • Enderby Island, Rosemary Island, Keast Island, Legendre Island, Delambre Island, Dixon Island, Bells Beach, Cooling Water Beach	• Hawksbill turtle (*Eretmochelys imbricata*), green turtle (*Chelonia mydas*) and flatback turtle (*Natator depressus*) nesting and breeding • Delambre and Legendre beaches are particularly important for flatback turtle.

[34] *If an OWR is required in WA State waters, the DBCA is responsible for the administration of the Western Australian Oiled Wildlife Response Plan (WAOWRP) under the direction of the DoT.*

Wildlife priority protection area	Key locations / fauna type	Reason
	Marine mammals and birds	• Dugongs (*Dugong dugon*) • Humpback whale (*Megaptera novaeangliae*) nursery area • Seabirds including little corella (*Cacatua sanguinea*), boobies (*Sula* sp.) and noddys (*Anous* sp.). • Keast Island provides one of the few nesting sites for pelican (*Pelecanus sp.*) in WA.

Table 15-4: Key wildlife activities in the Pilbara/Kimberley regions and corresponding time of year

Wildlife type	Activity	Period
Humpback whales	Migration pathway to and from Kimberley calving grounds	Peak between Jun-Aug
Dugong	Breeding Mating	Mar-Aug Aug-Mar
Marine turtles	Nesting Hatching	Sep-Dec Jan-April
Shorebirds	Migratory pathway stop-over	Sep-Apr

15.3 Magnitude of wildlife impact

Given the distribution and behaviour of wildlife in the marine environment, a spill which only impacts offshore waters is likely to result in limited opportunities to rescue wildlife. In such instances, continued wildlife reconnaissance, carcass recovery, sampling of carcasses that cannot be retrieved and scientific monitoring are more likely to be the focus of response efforts. In contrast, a spill which results in shoreline accumulation is likely to result in far greater wildlife impacts and opportunities to rescue wildlife.

The oil spill modelling for the worst-case spill scenarios for the Reindeer/DC activities predicts that the greatest accumulation of oil will occur at Montebello Islands, Northern Islands Coast, Lowendal Islands and Dampier Archipelago. Using the WAOWRP (DBCA 2022a) Guide for Rating the Wildlife Impact of an Oil Spill (Table 15-5), and stochastic modelling for the worst-case spill scenarios (Section 6.3), it is predicted that high wildlife impacts have the potential to occur as a result of a worst-case spill scenario associated with this activity.

Table 15-5: WAOWRP Guide for rating the wildlife impact of an oil spill

Wildlife Impact Rating	Low	Medium	High
What is the likely duration of the wildlife response?	< 3 days	3-10 days	>10 days
What is the likely total intake of animals?	< 10	11-25	>25
What is the likely daily intake of animals?	0-2	2 to 5	>5
Are threatened species, or species protected by treaty, likely to be impacted, either directly or by pollution of habitat or breeding areas?	No	Yes – possible	Yes – likely
Is there likely to be a requirement for building primary care facility for treatment, cleaning and rehabilitation?	No	Yes – possible	Yes – likely

Source: DBCA (2022)

15.4 Implementation guidance

Refer to Section 6 of the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for guidance on the tasks and responsibilities that should be considered when implementing an OWR when Santos is the Control Agency or prior to formal hand over to the relevant Control Agency. The implementation guidance within the Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) includes:

- Record keeping

- Situational awareness
- Activation of Santos IMT Wildlife Branch
- Notifications
- Santos Oiled Wildlife Rapid Assessment Teams (RATs)
- Wildlife Reconnaissance
- Santos Oiled Wildlife Sample Collection Protocol
- Wildlife Reconnaissance
- Mobilisation of required resources
- Handover to external Control Agency (if relevant).

The OWR first strike plan will focus on notifications, wildlife reconnaissance and response preparation (refer to Section 6.1 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]). Refer to Table 15-6 for an indicative timeframe and Appendix P for resource capability. Preventative actions, such as hazing, along with capture, intake and treatment require a higher degree of planning, approval (licences) and skills and will be planned for and carried out under the wildlife portion of the IAP (refer to Section 6.2 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]).

Table 15-6: Oiled wildlife response – first strike response timeline

Task	Time from oiled wildlife contact (predicted or observed)
IMT notifies regulatory authorities and AMOSC of oiled wildlife / potential for contact	<2 hours
Mobilise Santos personnel for oiled wildlife reconnaissance (this will be already occurring through Aerial Observer mobilisation and Shoreline Assessment Team mobilisation)	<24 hours
Mobilisation of AMOSC oiled wildlife equipment and industry OWR team to forward staging area	<48 hours
Minimum Resource Requirements	
The requirements for oiled wildlife response will be situation specific and dependent upon reconnaissance reports. First strike resources: • Reconnaissance platforms (Refer to Santos Oiled Wildlife Framework Plan (7700-650-PLA0017) and Appendix P) • 6 x trained industry oiled wildlife response team personnel (AMOSC staff & contractors/ AMOSC Industry OWR group) Additional resources: • Refer to Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) • Refer to Appendix P for information on OWR capability and equipment	

15.5 Environmental performance

Table 15-7 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 15-7: Environmental performance – oiled wildlife response

Environmental performance outcome	Implement tactics in accordance with the Santos Oil Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Oiled Wildlife Response	**Response preparedness**		
	Access to oiled wildlife response equipment and personnel	[EPS-OWR-001] Access to oiled wildlife response equipment and personnel through Santos, AMOSC, AMSA	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract.

Environmental performance outcome	Implement tactics in accordance with the Santos Oil Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		National Plan and OSRL maintained throughout activity as per Appendix P.	OSRL Associate Member Contract.
	Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017)	[EPS-OWR-005] Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) provides guidance for coordinating an OWR when Santos is the Control Agency and outlines Santos' response arrangements	Santos Oiled Wildlife Framework Plan (7710-650_PLA-0017) Revision records
	Access to labour hire personnel	[EPS-OWR-003] Maintenance of contract with labour hire provider	Labour hire contract
	Labour hire onboarding procedure to access labour hire personnel	[EPS-OWR-004] Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Access to Santos trained oiled wildlife response personnel	[EPS-OWR-002] Maintain Santos personnel trained on OWR and positioned at Perth and VI	Training records
	Response implementation		
	First strike capability mobilised	[EPS-OWR-006] First strike is mobilised in accordance with details and timings as specified in Table 15-6 unless directed otherwise by relevant Control Agency	Incident log
	OWR Management	[EPS-OWR-007] OWR managed in accordance with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017)	Incident log
	Prepare operational NEBA prior to operations commencing	[EPS-OWR-008] Prepare operational NEBA to determine magnitude of wildlife impact and determine if OWR activities are likely to result in a net environmental benefit (particularly in relation to hazing and pre-emptive capture). Operational NEBA to be undertaken each operational period.	IAP; Incident log
	IAP Oiled Wildlife Response Sub-plan developed, including waste management, to provide oversight and management of OWR operations	[EPS-OWR-009] IAP Oiled Wildlife Response Sub-plan is developed to ensure effective, coordinated execution with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017) and minimise environmental impacts from response	Incident log indicates IAP Oiled Wildlife Response Sub-plan prepared prior to oiled wildlife response operations commencing
	Oiled Wildlife Sample Collection Protocol	[EPS-OWR-010] Oiled wildlife sample collection carried out in accordance with the Santos Oiled Wildlife Sample Collection Protocol	Incident log

16. Operational and scientific monitoring

OSM is a key component of the environmental management document framework for offshore petroleum activities, which includes activity EPs and OPEPs. Operational monitoring is instrumental in providing situational awareness of a hydrocarbon spill, enabling the IMT to mount a timely and effective spill response and continually monitor the effectiveness of the response. Scientific monitoring is also the principal tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and for informing resultant remediation activities.

Santos has developed a North West Shelf OSM-BIP (7715-650-ERP-0002) which describes a program of monitoring oil pollution that will be adopted in the event of a hydrocarbon spill incident (Level 2–3) to marine waters. It aligns with the Joint Industry Operational and Scientific Monitoring Framework (APPEA, 2021) and describes how this Framework applies to Santos activities and spill risks for the geographic extent of the North West Shelf OSM-BIP (7715-650-ERP-0002). The relationship between the Joint Industry OSM Framework and Santos environmental management framework is illustrated in Figure 16-1.

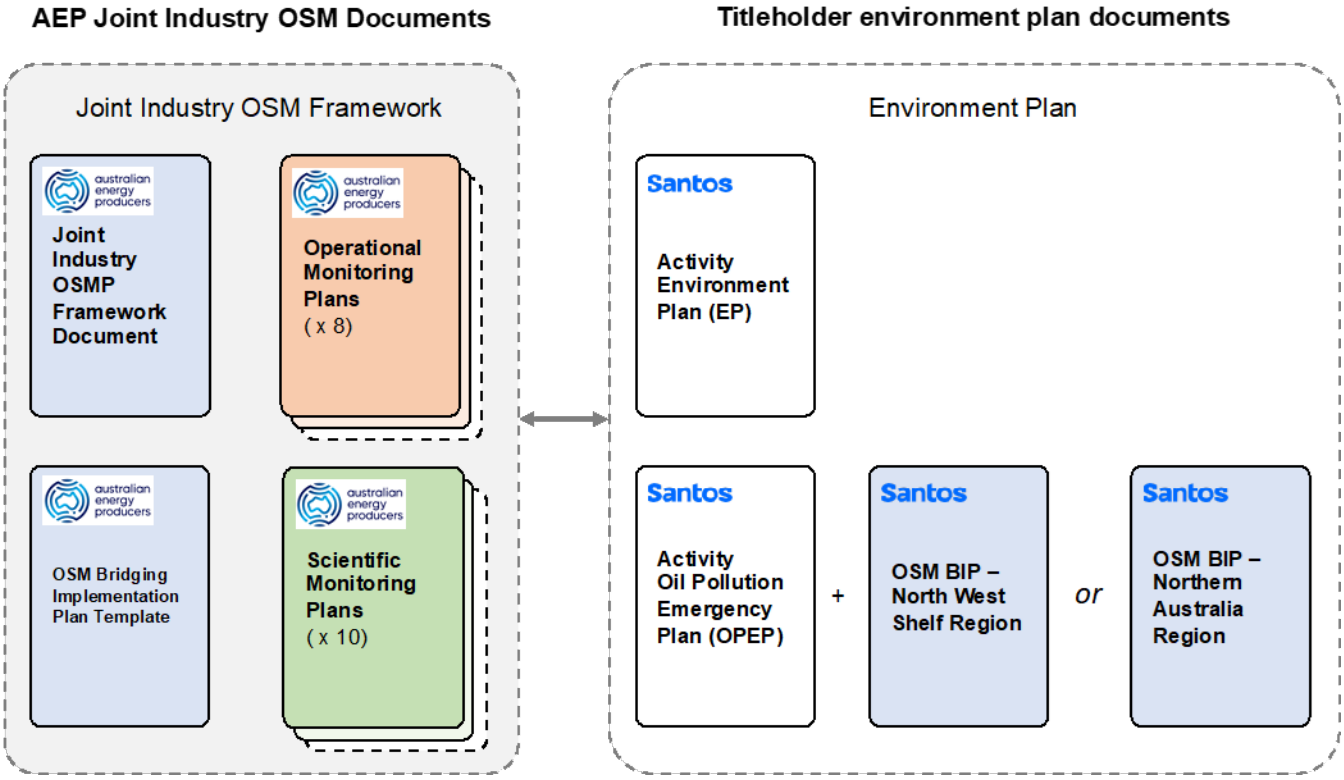

Figure 16-1: Relationship of Joint Industry and Titleholder OSM Documentation

The Northern Australia OSM-BIP is structured so that it can provide a flexible framework that can be adapted to individual spill incidents. A series of Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs) form part of the Joint Industry OSM Framework and provide detail on monitoring design, standard operating procedures, data management, quality assurance and quality control and reporting.

There are two types of monitoring that would occur following a Level 2–3 spill event:

- **Operational Monitoring** – which is undertaken during the course of the spill and includes any physical, chemical and biological assessments that may guide operational decisions such as selecting the appropriate response and mitigation methods and / or to determine when to terminate a response activity. This monitoring is additional to the activities (aerial/vessel surveillance, tracking buoys, oil spill trajectory modelling and satellite tracking) performed as part of the Monitor and Evaluate Strategy (Section 10). The design of operational monitoring requires judgements to be made about scope, methods, data inputs and outputs that are specific to the individual spill incident, balancing the operational needs of the response with the logistical and time constraints of gathering and processing information. Information needs to be collected and processed rapidly to suit response needs, with a lower level of sampling and accuracy needed than for scientific purposes. For details on initiation and termination criteria for OMPs refer to the North West Shelf OSM-BIP (7715-650-ERP-0002).
- **Scientific Monitoring (SM)** – which can extend beyond the termination of response operations. Scientific monitoring has objectives relating to attributing cause-effect interactions of the spill or associated response with changes to the surrounding environment. SM will be conducted on a wider study area, extending beyond the

spill footprint, will be more systematic and quantitative, and aim to account for natural or sampling variation. For further details on the SMPs refer to the OSM-BIP.

Table 16-1 lists the Joint Industry OMPs and SMPs that are relevant to this OPEP.

The North West Shelf OSM-BIP (7715-650-ERP-0002) is tailored to Santos' activities on the north west shelf. It includes details on priority locations for monitoring, resourcing requirements; and operational guidance including logistics, mobilisation and permitting; with the exception of capability requirements for OMP: Shoreline Clean-up Assessment. The capability requirements for OMP: Shoreline Clean-up Assessment are typically assessed for each activity, according to deterministic modelling for the worst-case scenario that shows the simulation with the longest length of shoreline contacted, as this criterion influences the number of assessment teams required. Resourcing requirements for OMP: Shoreline Clean-up Assessment for this OPEP activity are provided in Appendix M.

The capability assessment for the remaining OMPs and SMPs is assessed against different deterministic modelling criteria, as described in the North West Shelf OSM-BIP (7715-650-ERP-0002). The North West Shelf OSM-BIP (7715-650-ERP-0002) describes the methodology for assessing the worst-case OSM capability requirements for Santos activities in this region. In summary, Santos assessed the worst-case spill scenario for OSM capability as the scenario contacting the most receptors at the low thresholds at a probability >5% and within 7 days. Santos confirms that all the Reindeer and Devil Creek spill scenarios (Section 6.1) fit within the OSM combined Scientific Monitoring Planning Area and assessment criteria defined within Appendix A of the North West Shelf OSM-BIP (7715-650-ERP-0002). Further, receptors contacted are all included within the baseline priority list in Section 2.2 of the North West Shelf OSM-BIP (7715-650-ERP-0002). This assessment is detailed in Appendix N.

Santos will review the initiation criteria for OMPs and SMPs (provided in Table 9-1 (OMPs) and Table 9-2 (SMPs) of the Joint Industry Operational and Scientific Monitoring Framework (APPEA, 2021) when preparing the initial IAPs, and subsequent IAPs. If any initiation criteria are met, then that relevant OMP and/or SMP will be activated via the OSM Services Provider.

Table 16-1: Joint Industry Operational and Scientific Monitoring Plans relevant to the activity

Operational monitoring	Relevant for this OPEP	Scientific Monitoring	Relevant for this OPEP
Hydrocarbon Properties and Weathering Behaviour at Sea	✓	Water Quality Impact Assessment	✓
Water Quality Assessment	✓	Sediment Quality Impact Assessment	✓
Sediment Quality Assessment	✓	Intertidal and Coastal Habitat Assessment	✓
Surface chemical dispersant effectiveness and fate assessment	✓	Seabirds and Shorebirds Assessment	✓
Subsea chemical dispersant effectiveness and fate assessment	✓	Marine Mega-fauna Assessment	✓
Rapid Marine Fauna Surveillance	✓	Benthic Habitat Assessment	✓
Shoreline Clean-up Assessment	✓	Marine fish and elasmobranch assemblages assessment	✓
-	-	Fisheries Impact Assessment	✓
-	-	Heritage Features Assessment	✓
-	-	Social Impact Assessment	✓

16.1 Environmental performance

Table 16-2 indicates the environmental performance outcomes, control measures, performance standards and measurement criteria for operational and scientific monitoring.

Table 16-2: Environmental performance – operational and scientific monitoring

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Response preparedness			
Operational and Scientific monitoring – Preparedness	Maintenance of OSM Services Provider (MSP) contract	[EPS-OSM-002] Maintain contracts with third-party provider/s to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of monitoring	Contract with OSM services provider
	OSM Services Provider capability verified through regular capability reporting	[EPS-OSM-003] Obtain monthly capability reports from OSM services provider to demonstrate suitable resources are available throughout the activity	Monthly capability reports from OSM Services Provider
	Adequacy of existing baseline data sources across the Santos combined Scientific Monitoring Planning Area reviewed periodically	[EPS-OSM-004] Regular review of existing baseline data	Baseline data review report
	Water quality monitoring vessels	[EPS-OSM-006] Maintenance of vessel specification for water quality monitoring vessels within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Vessel specification
	Pre-completed risk assessment for operational and scientific monitoring activities	[EPS-OSM-016] Pre completed and approved risk assessment is in place with the OSM Services Provider for operational and scientific monitoring activities	OSM Services Provider pre-completed and approved risk assessment
	Access to Santos oil sampling kits	[EPS-OSM-001] Oil sampling kits pre-positioned at Exmouth, Dampier and Varanus Island. Equipment contents as per Appendix C of the Santos Oil and Water Sampling Procedures (7710-650-PRO-0008).	Evidence of deployment to site
	OSM Services Provider testing and exercising	[EPS-OSM-005] Annual testing of OSM Services Provider arrangements and capability	Exercise and testing records
	OSM-BIP reviewed annually	[EPS-OSM-030] Annual review of OSM-BIP	Record of revision
Response implementation			
Operational and Scientific monitoring – Activation and Mobilisation	Activate Operational and Scientific Monitoring Plans	[EPS-OSM-010] OMPs and SMPs will be activated in accordance with the initiation criteria provided in Table 9-1 and 9-2 of the Joint Industry	Incident Action Plan and Incident Log confirm OMPs and SMPs are activated in accordance with the initiation criteria

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		OSM Framework (APPEA, 2021)	provided in Table 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)
	Activation of operational and scientific monitoring plans according to OMPs and SMPs initiation criteria	[EPS-OSM-009] Initiation criteria of OMPs and SMPs will be reviewed during the preparation of the initial Incident Action Plan (IAP) and subsequent IAPs; and if any criteria are met, relevant OMPs and SMPs will be activated	IAP/s Incident log
	OSM BIP	[EPS-OSM-025] Monitoring to be conducted in accordance with the Santos North West Shelf OSM-BIP (7715-650-ERP-0002.)>	Incident log; Monitoring records
	OSM implementation Minimum Standards	[EPS-OSM-026] Implementation of operational and scientific monitoring will comply with the Minimum Standards listed in Appendix A of the Joint Industry OSM Framework (APPEA, 2021)	Incident log; Monitoring records
	OSM Services Provider to commence activation within specified time from initial notification	[EPS-OSM-011] OSM services provider shall commence activation process within 30 mins of initial Call-off Order form being received from Santos	OSM services provider records
	Santos to provide support to OSM Services Provider	[EPS-OSM-012] Santos personnel to support OSM services provider through the provision of monitor and evaluate information and relative location of sensitive receptors to the spill	Incident log; OSM services provider records
	Mobilisation of appropriately specified monitoring vessels	[EPS-OSM-017] Source monitoring vessel(s) with specification in accordance with Section 5.2 of Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Incident log
Operational and Scientific monitoring – Water quality	Ecotoxicity testing of oil samples to take place	[EPS-OSM-007] Oil samples collected to be sent for laboratory ecotoxicity testing of oil	Incident log
	Ecotoxicity testing to derive species protection triggers	[EPS-OSM-008] 90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum five species' tests) within 24 hours of receiving all results	Ecotoxicity report from environmental contractor
Operational and Scientific monitoring – Shoreline	Use of shallow draft vessels for shoreline and nearshore operations	[EPS-OSM-020] Shallow draft vessels are used for shoreline and nearshore operations	Vessel specification documentation contained in IAP

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
assessment and nearshore operations		unless directed otherwise by the relevant Control Agency	
	Shoreline clean-up assessment direction and leadership	[EPS-OSM-018] OMP: Shoreline Clean-up Assessment will be implemented under the direction of the relevant Control Agency	Incident log
	SCAT Field Coordinator assessment/selection of vehicle appropriate to shoreline conditions	[EPS-OSM-021] SCAT Field Coordinator assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/ nearshore habitat/ bathymetry assessment	[EPS-OSM-022] Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities	IAP records; Assessment records
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat	[EPS-SM-023] Unless directed otherwise by the designated Control Agency, demarcation zones are mapped out in sensitive habitat areas	IAP demonstrates requirement is met
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	[EPS-OSM-024] Unless directed otherwise by the designated Control Agency, action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met
	Daily SCAT reports issued during SCAT operations	[EPS-OSM-019] Reports from OMP: Shoreline Clean-up Assessment will be provided to the IMT daily, detailing the assessed areas to maximise effective utilisation of resources	Incident log
Operational and Scientific monitoring – Stand-down and termination	Stand-down, termination and post-spill activities	[EPS-OSM-027] Once post-spill SMP monitoring reports are drafted they will be peer reviewed by an expert panel	Monitoring records
	Stand-down, termination and post-spill activities	[EPS-OSM-028] OMPs and SMPs will be terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)	Incident Action Plan and Incident Log confirm OMPs and SMPs are terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)

17. Waste management

Table 17-1 lists the environmental performance outcome, initiation and termination criteria for this strategy.

Table 17-1: Waste management – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible	
Initiation criteria	Response activities that will be generating oily waste have been initiated.	
Applicable hydrocarbons	**Reindeer Condensate**	**MDO**
	✓	✓
Termination criterion	• All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements; and • Agreement is reached with Jurisdictional Authorities to terminate the response	

17.1 Overview

The implementation of some spill response strategies will generate solid and liquid waste that will require rapid management, storage, transport and disposal. It is important that waste is collected and removed quickly to ensure waste management does not create a bottleneck in response operations.

The type and amount of waste generated during a spill response will vary depending on the spill type/characteristics, volume released, and response strategies implemented. To account for this potential variability, waste management (including handling and capacity) needs to be scalable to allow a continuous response to be maintained.

Where Santos is the Control Agency, or at the request of the designated Control Agency, Santos will engage its contracted Waste Service Provider (WSP) to provide sufficient waste receptacles to store collected waste and manage oily waste collection, transport and disposal associated with spill response activities. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to licensed waste management facilities. All transport will be undertaken via controlled-waste-licensed vehicles and in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001) provides detailed guidance to the WSP in the event of a spill.

Where DoT is the Control Agency, Santos will provide a Deputy Waste Management Coordinator to the DoT IMT Logistics Unit to support the DoT IMT in coordinating waste management services (as per

Table 5-5).

17.2 Implementation guidance

Table 17-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 17-2: Implementation guidance – waste management

Action		Consideration	Responsibility	Complete
Initial Actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Incident Response Contacts Directory (7700-650-PLA-0016.20) for contact details.	Logistics Section Chief	☐
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations.	It is better to overestimate volumes and scale back resources then to underestimate waste volumes.	Logistics Section Chief Planning Section Chief	☐
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established.	Shoreline waste collection points (temporary storage site) will be determined by the DoT and will depend upon the location of shoreline clean-up activities and staging areas and the availability of vehicle access routes. Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through Department of Water and Environmental Regulation (DWER).	Logistics Section Chief Planning Section Chief Environment Unit Leader	☐
	For each receival location indicate the anticipated: • material types • material generation rates • material generation quantities • commencement date/time • anticipated clean-up duration • receptacle types required • logistical support requirements • any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to *Oil Pollution Waste Management Plan* [7715-650-ERP-0001]).	Consider facilities for waste segregation at source.	Logistics Section Chief Planning Section Chief	☐
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP.	Waste management should be conducted in accordance with Santos' *Oil Pollution Waste Management Plan* (7715-650-ERP-0001); and where relevant, the DoT *Waste Management Guidelines*, and the respective Port, Port Operator and/or Ship Owner's waste management plan.	Logistics Section Chief Planning Section Chief Deputy Waste Management Coordinator (DoT IMT) WSP Operations Supervisor	☐

Action		Consideration	Responsibility	Complete
	Mobilise waste management resources and services to agreed priority locations.	-	WSP Operations Supervisor Logistics Section Chief Deputy Waste Management Coordinator (DoT IMT)	☐
Ongoing Actions	Provide ongoing point of contact between IMT and WSP.	If DoT is the Control Agency, the Deputy Waste Management Coordinator shall be the point of contact between DoT and the WSP.	Deputy Waste Management Coordinator (DoT IMT) Logistics Section Chief	☐
	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate) if any non-compliance is anticipated or detected. Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan.	WSP Operations Supervisor	☐
	Ensure records are maintained for all waste management activities, including but not limited to: • waste movements (including types of receptacles, receival points, temporary storage points, final disposal locations) • volumes generated at each site (including total volume and generation rates) • types of waste generated at each site • approvals obtained (as required).	-	WSP Operations Supervisor	☐

17.3 Waste approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through the Department of Water and Environmental Regulation (DWER).

DWER administers the *Environmental Protection Act 1986* (WA) and is the relevant regulatory authority for waste management in WA. The Santos Oil Pollution Waste Management Plan (7715-650-ERP-0001) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

If required, DoT may establish an Operational Area Support Group (OASG), as defined in the SHP-MEE, to request support from relevant WA Government Agencies, including DWER, during a State waters spill response. The Santos' Waste Management Plan – Oil Spill Response Support (7715-650-ERP-0001) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

17.4 Waste service provider capability

Detailed guidance on Santos' WSP responsibilities for spill response waste management is provided in the Santos Oil Pollution Waste Management Plan (7715-650-ERP-0001).

Key responsibilities of the WSP include:

- Maintain emergency response standby preparedness arrangements, including:
  - Access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos worse case spill and waste requirements
  - Provide primary and secondary contact details for activation of NWA's spill response waste management services
  - Access to suitably trained personnel for completing critical tasks in spill response waste management
  - Participate in exercising undertaken by Santos.
- Maintain ability to assist in the Control Agency's IAP and Waste Management Sub-plan process as required.
- Mobilise resources to waste collection points identified by the Control Agency.
- Ensure waste handling, transport and disposal practices meet legislative requirements.
- Keep auditable records of waste streams from collection points to final disposal points.
- Provide regular progress reporting to the Control Agency IMT and a final report relating to quantities and destinations of collected waste.
- Provide a project manager responsible for the rollout of spill response resources to meet spill response waste management objectives.
- Provide location specific Operations Supervisor/s to handle on-site operational aspects (management of personnel and equipment, reporting, liaison with relevant field-based spill responders)

17.5 Waste management resources

Santos has access to capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points.

Table 17-3 provides the capability of the waste service provider for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP. The weekly removal capacity is 8,778 m^3. From stochastic modelling and using a bulking factor of 10, the maximum waste collected during shoreline clean-up is from Scenario 6 (MDO spill resulting from a vessel collision at the HDD Crossing (325 m^3), conservatively estimated at 2,080 m^3 in total (refer to Table 13-5). The maximum accumulation including a conservative bulking factor, evaluated in shoreline clean-up Section 13.4 is exceeded by the waste service provider total removal capacity specified in Table 17-3.

Table 17-3: North West Alliance vehicle and equipment availability

Plant and Equipment	No	Capacity	Functionality	Uses per week	Waste stored/shifted per week (m^3)
Waste removal					
Oily waste					
Skip lift truck	14	Lift up to 10 t, 4.3 m^3 per service	Servicing of skip bins	7	420
Front lift truck	10	28 m^3 body, 11.2 m^3 per service	Servicing of front lift bins	7	784
Side loading truck	10	18 m^3 body, 7.2 m^3 per service	Servicing of MGB's	7	504
Hook lift truck	8	Lift up to 15 t, 17.5 m^3 per service	Servicing of hook lift bins	7	980
Flat bed truck	16	15 pallet spaces, 17.5 m^3 per service	Servicing of bins	7	840
Liquid oil					
Liquid waste tankers (triple 'road-train' configuration)	10	75 m^3 capacity	Collection of liquid waste at the port of reception (Dampier)	7	5,250
Waste storage					
Oily waste					
ISO-tainers	15	22 m^3 capacity	Various waste streams	2	660
MGBs	500	240L	Mobile bins	2	240
Offshore 8 pack Lifting Cradle (MGBs)	2	16 x 240L MGBs	Able to remove 16 x 240L MGBs simultaneously	continuous	
Lidded bins	6	1,100L	contain various waste streams	2	13
Front lift bins	50	3 m^3	various waste streams	2	300
Front lift bins	25	4.5 m^3	various waste streams	2	225
Offshore rated front lift bins	100	3 m^3	various waste streams	2	600
Offshore rated skip bins	45	7 m^3	various waste streams	2	630
Marrell skip bins (onshore)	60	6–9 m^3, assumed 8 m^3 per service	various waste streams	2	960
Hook lift bins	12	15–30 m^3, assumed 23 m^3 per service	various waste streams	25	6,900
Forklift	4	4 t forklift	All areas	continuous	
Weekly waste storage capacity					**10,528**
Weekly total waste removal capacity					**8,778**
Weekly liquid oil removal capacity					**5,250**

Source: As per Oil Pollution Waste Management Plan (7715-650-ERP-0001)

17.6 Environmental performance

Table 17-4 indicates the environmental performance outcome, control measures, performance, standards and measurement criteria for the response strategy.

Table 17-4: Environmental performance – waste management

Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible.		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Waste management	**Response preparedness**		
	Access to waste management equipment, personnel, transport and disposal facilities	[EPS-WM-001] Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained throughout activity.	Contract with WSP for emergency response services Annual desktop assurance report.
	Access to vessels for waste transport	[EPS-WM-002] MSAs with multiple vessel providers maintained throughout activity.	MSAs with vessel providers
	Response Implementation		
	Implement Oil Pollution Waste Management Plan (7715-650-ERP-0001)	[EPS-WM-004] WSP shall: Appoint a Project Manager within 24 hours of activation Track all wastes from point of generation to final destination Provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Incident Log; Waste tracking records
		[EPS-WM-007] WSP to provide waste bins for oil and oily waste for shoreline clean-up operations to clean-up site or deployment port, if requested, within 24 hours	Incident log
	Compliance with controlled waste, unauthorised discharge and landfill regulations	[EPS-WM-008] Waste handling and disposal compliant with: - Environmental Protection (Rural Landfill) Regulations 2002 - Environmental Protection (Unauthorised Discharges) Regulations 2004 - Environmental Protection (Controlled Waste) Regulations 2004	Waste tracking records demonstrate requirement is met

18. Response termination

The decision to terminate the spill response is made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role. This decision will be made with consideration of:

- the efficacy and benefit of current response options
- any potential for additional pollution
- any potential for additional environmental damage caused by further clean-up efforts
- an assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.

An operational NEBA will be conducted to inform the decision-making process. Termination criteria are defined within each section of contingency response activities defined within the OPEP.

Upon conclusion of the spill response activity, Santos will:

- prepare detailed reports and collate all documents
- report on the performance objectives of each individual spill response that was mobilised
- undertake an inventory of consumables and prepare accounts
- arrange for the return of equipment
- arrange for the refurbishment of consumed equipment
- conduct an investigation into the cause of the incident and report to relevant authorities
- assess long-term scientific monitoring requirements.

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Appendix A Hydrocarbon characteristics and behaviour

Marine diesel oil (MDO)

ITOPF (2023) and RPS (2024) categorise MDO as a Group II light persistent oil. The physical characteristics of MDO are summarised in Table A-1. 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, which will decay slowly over time.

The MDO has a density of 890.0 kg/m^3 at 15ºC (API of 27.5) and a low pour point of -9.0°C. The low viscosity (14.0 cP at 25°C) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation.

Generally, about 4% of the MDO mass should evaporate within the first 12 hours (BP < 180°C); a further 32% should evaporate within the first 24 hours (180°C < BP < 265°C); and an additional 54% should evaporate over several days (265°C < BP < 380°C). Approximately 10% (by mass) of MDO will not evaporate, though will decay slowly over time.

It's noteworthy that the heavier components for the condensate (and the MDO), specifically the low volatile and persistent portions, will have a strong tendency to become entrained into the water column in the presence of moderate winds (above 10 knots) and in turn breaking waves, however, it can re-surface under calm conditions (less than 10 knots).

In summary, in the marine environment MDO will behave as follows:

- Will spread rapidly in the direction of the prevailing wind and waves
- In calm conditions evaporation is the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60–80% reduction of the net hydrocarbon balance
- Has a strong tendency to entrain into the upper water column (0–10 m) (and consequently reduce evaporative loss) in the presence of moderate winds (>10 knots) and breaking waves. However, it re-surfaces when the conditions calm
- The evaporation rate of MDO will increase in warmer air and sea temperatures such as those present around the area
- MDO 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.

Table A-1: Properties of MDO

Hydrocarbon type	Density (kg/m^3)	Dynamic viscosity at 25 °C (cSt)	API	Wax content (%)	Pour point °C
MDO	890.0 (@15 C)	14.0	27.5	1	−9

Source: RPS (2024)

Reindeer condensate

The physical characteristics of Reindeer condensate are summarised in Table A-2. Reindeer condensate assay results show the condensate to be highly volatile with low viscosity. The weathering curve for Reindeer condensate indicates that a large proportion of the condensate will evaporate rapidly. Evaporation rates will increase with temperature, but in general about 74% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 17% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 8% should evaporate over several days (265 °C < BP < 380 °C). It is then expected that the remaining 1% consisting of waxy hydrocarbons, shall persist in the marine environment for much longer periods and would be subject to relatively slow degradation.

The whole condensate has a low asphaltene content (<0.5%), indicating a very low tendency for the hydrocarbons to take up water to form water-in-oil emulsions over the weathering cycle.

However, because the oil would be released into the water column under the spill scenarios, there will be variable periods of time required for the droplets to surface before atmospheric weathering can commence. This factor will extend the effective weathering time for the oil and will result in variable compartmentalisation of the oil between the water surface and the water column over time.

Table A-2: Properties of Reindeer condensate

Hydrocarbon type	Density (kg/m^3)	Dynamic viscosity at 20°C (cSt)	API	Wax content (%)	Pour point °C	Asphaltene (%)
Reindeer condensate	784.2 (@15 C)	0.683	48.9	<5%	-36	<0.5

Source: Intertek (2023)

Appendix B Oil spill response ALARP framework & assessment

ALARP Assessment Framework

Rationale

As of part the regulatory approval requirements for petroleum activities, the EP and/or OSCP must demonstrate that through the implementation of all reasonable control measures environmental risks have been reduced to a level that is As Low As Reasonably Practicable (ALARP).

With respect to hydrocarbon spill risk and response planning, this includes an assessment to demonstrate that the oil spill response control measures are reducing risk to a level that is ALARP.

This ALARP Assessment Framework provides a process to facilitate the identification of all existing and potential spill response control measures, the selection or rejection of which are supported by reasoned arguments.

Guidance documents

Guidance documents used in the preparation of this framework include:

- Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003)
- NOPSEMA Guidance Note ALARP (N-04300-GN0166, August 2022)
- NOPSEMA Guidance Note Control Measures and Performance Standards (N04300-GN0271, Revision 26 June 2020)
- NOPSEMA Guideline Environment Plan Decision Making (N-04750-GL1721, January 2024)
- NOPSEMA Guidance Note Risk Assessment (GN0165, June 2020)
- NOPSEMA Oil Pollution Risk Management (GN1488, October 2024).

Overview

The ALARP Assessment Framework uses activity-specific information to systematically assess existing and potential control measures and ensure that all practicable control measures are identified and documented.

When selecting controls to reduce risk is it good practice to apply a preferential order; elimination, substitution, prevention, reduction and mitigation. In the context of this ALARP Assessment Framework for oil spill response, all control measures are response strategies to reduce the impacts of an unplanned event that has already occurred. All source control response measures may be classed as ‘reduction’ in the hierarchy of controls with all other response measures classed as ‘mitigation’.

The ALARP Assessment Framework is shown in Figure B-1.

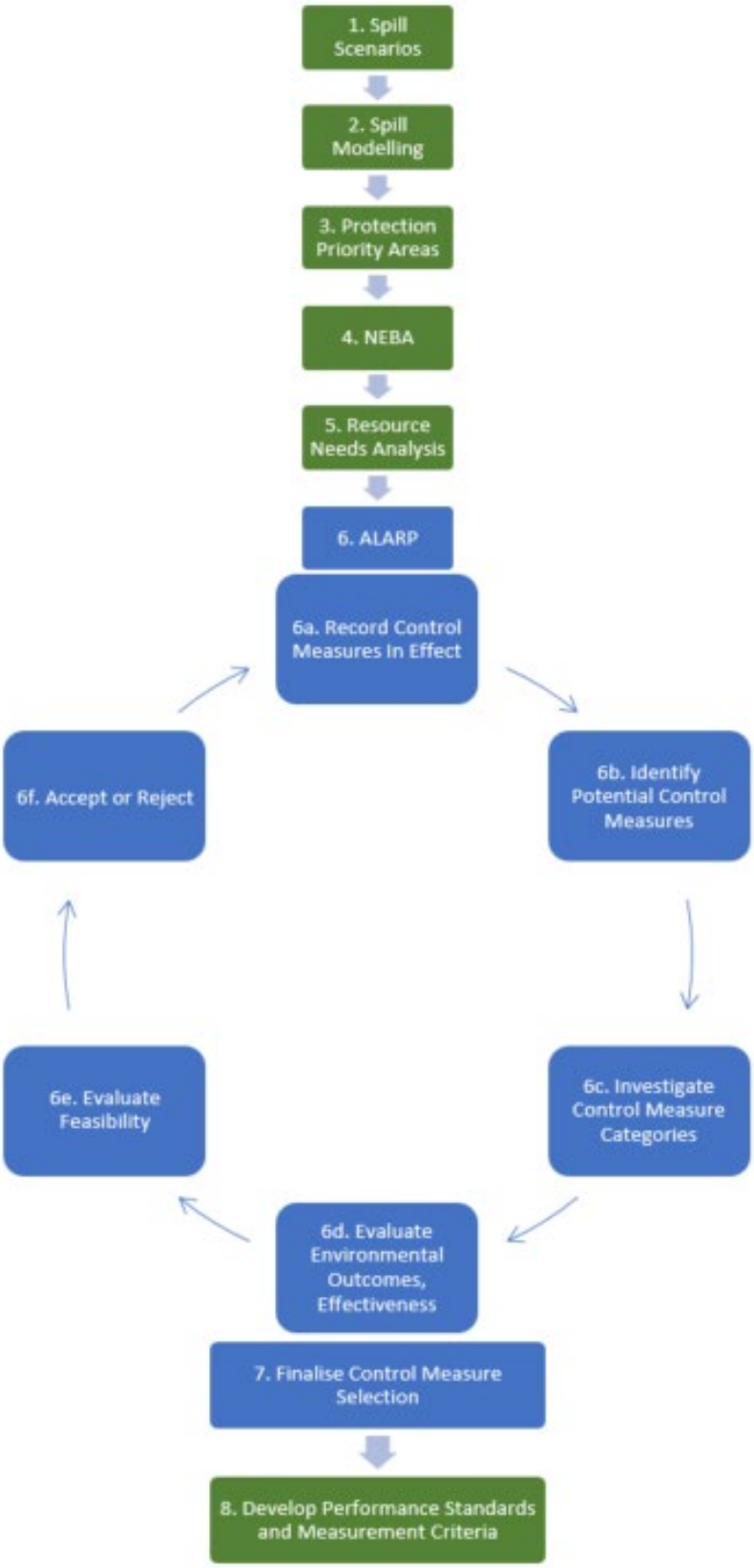


Figure B-1: ALARP Assessment Framework

In Figure B-1, Steps 1 to 5 (in GREEN) denote input information into the ALARP Assessment Framework. This information comprises:

1. **Spill Scenarios**: This step will involve assessing all possible spill scenarios from the activity and identifying the worst-case credible scenarios as a basis for pollution response planning.
2. **Spill Modelling**: A quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.

3. **Protection Priority Areas**: The Environment that may be Affected (EMBA) is the largest area within which impacts from hydrocarbon spills associated with the activity could extend. The EMBA is predicted using spill modelling results from Step 2. Protection Priority Areas (PPA) are locations of high ecological value within the EMBA that would be targeted in response. Selection of PPAs is detailed in the Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003).
4. **NEBA**: Net Environmental Benefit Analysis (NEBA) is used to select the most effective response strategies to protect the PPAs identified in Step 3.
5. **Resource Needs Analysis**: For the response strategies identified through NEBA, the worst-case resource, timing and location requirements are determined using quantitative spill modelling information where applicable. Implementation Guidance is then developed to detail what arrangements and actions are required to be initiated by the Incident Management Team (IMT) to meet the incident requirements up to a worst-case incident.

Through the development of the Implementation Guidance, it may be possible to identify resource, timing and location requirements that could be improved. These areas of improvement should be noted in the ALARP so that additional, alternative or improved control measures can be considered in this context.

A detailed ALARP Assessment Framework for the evaluation of control measures is shown in Figure B-1, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in Table B-1.

- 6a. Record Control Measures In Effect: The spill response control measures currently in place for Santos are listed here. The environmental outcomes and effectiveness of the in-effect control measures are noted using the Resource Needs Analysis to assess whether there are any areas of improvement. Environmental outcomes include potential harmful effects of control measures.
- 6b. Identify Potential Additional Control Measures: Potential control measures are identified with a focus on any control measures that address areas of improvement identified in Step 6a.
- 6c. Investigate Control Measure Categories: In-effect and potential control measures from Steps 6a and 6b are classified as either additional, alternative or improved, and as either people, system, equipment or procedures. This step serves as a prompt to ensure that potential control measures from all categories are explored.
- 6d. Evaluate Environmental Outcomes and Effectiveness: The environmental outcomes and effectiveness are assessed for all control measures identified and described through Steps 6a, b, and c.
- 6e. Evaluate Feasibility: Time, cost and effort required for implementation are assessed for all control measures identified and described through Steps 6a, b, and c.
- 6f. Accept or Reject: The potential control measure will be accepted or rejected on the basis of environmental outcomes and effectiveness described in Step 6d and whether cost is grossly disproportionate, as described in Step 6e.

When evaluating potential control measures, implementation plans of in-effect control measures are carefully considered to ensure that any accepted control measures will equal or improve Santos' capacity to meet resource needs. Potential control measures are also considered within the context of Santos' current response arrangements to determine if synergies or resource conflicts might occur.

As control measures are evaluated for selection or rejection, they can be compared with industry good practice to ensure that all practicable control measures were implemented. Where unique circumstances exist and further analysis is required, a different evaluation technique may be used, such as technical analysis, detailed cost benefit analysis or combination of approaches.

New information on risks, impacts and response strategies obtained through analysis of operations, exercises and scheduled documentation reviews can be incorporated into the ALARP Assessment Framework cycle in a process of continual improvement.

In Figure B-1, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

7. Finalised Control Measure Selection: Outputs from the ALARP Assessment shown in Step 6 comprise finalised control measures (in BLUE).
8. Develop Performance Standards and Measurement Criteria: For each control measure finalised in Step 7, performance standards and measurement criteria are then developed and documented in the OSCP (in GREEN).

Performance standards for all accepted control measures should be written to enable the operator to measure, monitor and test effectiveness. Only the key aspects of any given control will require performance standards and these may include the various measures of effectiveness; functionality, availability, reliability, survivability, dependency and compatibility. Parameters set in the performance standard should be 'SMART'; specific, measurable, appropriate, realistic and timely.

Corrective action based on deviations or trends in performance should be taken by amending either the performance standard or the control measure, as appropriate.

Criteria and definitions

Standardised criteria and definitions are used to bring consistency to the ALARP assessment across diverse activities and response strategies. Criteria and definitions are shown in Table B-1.

Table B-1: Criteria and definitions of ALARP Assessment Framework

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N 04750-GL1721 January 2024.
Control Measure Category	A range of different types of controls generally provide effective protection as they provide independence and multiple layers of protection. The OPGGS(S) Regulations refer to technical and 'other' controls where technical control measures involve hardware like shutdown valves and alarms. 'Other' control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: • People – personnel • System – organisation, information/communications, support facilities, training/ competency • Equipment – equipment • Procedures – doctrine Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using the following six criteria. **Functionality** • The functional performance of a control measure is what it is required to do. How does the control perform in order to achieve the required risk reduction? **Availability** • Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. **Reliability** • The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do with the probability that the system will function correctly and is usually measured by the mean time between failure. **Survivability** • Whether or not a control measure is able to survive a potentially damaging event such as fire or explosion is relevant for all control measures that are required to function after an incident has occurred. • To achieve their purpose, oil spill response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. **Dependency** • The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the

Column	Description
	failure of others, then the control measures are not independent, and it may not be appropriate to count such measures as separate. • Several control measures are reliant on equipment, people and vessels, hence have high dependence. **Compatibility** • Whether or not a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 June 2020.
Feasibility	Feasibility describes the time, cost and/or effort required to implement the Control Measure.
Accept/Reject	Outcome of assessment and key reasons for the decision

ALARP assessment summaries

ALARP assessment summary
Source Control
The control measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable in the context of the risk of a well release from the Reindeer WHP Operations. The drilling of a relief well is an effective control and relief well planning conducted in the area has demonstrated that a MODU will be on site for relief well drilling by day 47 from the start of a well release. Relief well construction can be completed within 91 days using a MODU, equipment and specialist personnel that Santos has arrangements to gain access to. An additional 2 weeks over the base-case of 77 days was included based on the planning assumption that a suitable jack-up MODU may not be available in Australian waters. As a result, additional time may be required to mobilise the MODU from international waters (i.e. Singapore) to the operational area. However, as it has been demonstrated that the well is anticipated to cease flowing due to the low gas rates and high-water rates corresponding to high water gas ratios, the total worst-case credible loss of well control volume is based on a release over 10 weeks (70 days). One additional, alternative or improved potential control measure was identified and assessed, which was rejected as grossly disproportionate to the potential reduction in environmental risk. The rejected control measure was: • Contract source control personnel through a provider in addition to existing arrangements Performance standards and measurement criteria that have been developed for the in effect control measures are shown in the OPEP. The key performance requirements for relief well drilling are the maintenance, tracking, access and relief well planning arrangements (during times of maintaining preparedness) and the timely mobilisation of resources (during a response). These key areas of effectiveness are reflected in the performance standards.
Monitor and Evaluate
For the monitor and evaluate strategy, various independent inputs from multiple service providers are used to build a detailed Common Operating Picture (COP) during the incident. Three additional, alternative or improved potential control measures were identified and assessed. Three additional, alternative or improved control measures were rejected as grossly disproportionate to the potential reduction in environmental risk: • Purchase of oil spill modelling system and internal personnel trained to use system • Purchase additional satellite tracking buoys • Ensure trained aerial observers based at strategic locations such as Exmouth, Port Hedland and Karratha. Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Section 10.6. The key areas of effectiveness for the identified control measures, during times of maintaining preparedness, focus on maintaining access to equipment and personnel through contractual arrangements with vessel providers, aircraft providers aerial observers, UAV providers, tracking buoys, oil spill trajectory modelling providers and satellite imagery providers.
Mechanical Dispersion
Mechanical dispersion is a secondary response strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment, and no areas of improvement were identified. The use of mechanical dispersion in a response would be assessed as part of an operational NEBA.

ALARP assessment summary
No additional, alternative or improved potential control measures were identified and assessed. Performance standards and measurement criteria that have been developed for the in effect control measures are shown in the OPEP. The key areas of effectiveness for the identified control measures during a response relate to the development of an operational NEBA to confirm suitability and environmental benefit of mechanical dispersion and the mobilisation of vessels. These key areas of effectiveness are reflected in the performance standards.
Shoreline Protection and Deflection
Large quantities of various types of nearshore booms and skimmers from Exmouth and Fremantle ensures that equipment is in place to implement this response strategy within 72 hrs in a wide range of metocean conditions. Trained regional Santos personnel can be quickly mobilised to appropriate locations using helo services, followed by AMOSC staff and AMOSC Core Group from Perth. These regional and state resources ensure that equipment and personnel are not a limiting factor in this response strategy. Three additional, alternative or improved potential control measures were identified and assessed. Three improved additional, alternative or improved potential control measures were rejected as grossly disproportionate to the potential reduction in environmental risk: • Santos to purchase additional shoreline and nearshore booms and ancillary equipment • Access to additional shallow draft boom tow vessels owned by Santos • Ensure trained personnel based at strategic locations such as Port Hedland, Karratha or Exmouth Performance standards and measurement criteria that have been developed for the in-effect and accepted control measures are shown in Section 12.4. The key areas of effectiveness for the identified control measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence protection and deflection operations and the preparation of an operational NEBA for each operational period that takes into account protection priorities and the ongoing effectiveness of the response strategy.
Shoreline Clean-up
Stockpiles in Fremantle or regional area and locally available supplies provide a range of shoreline clean-up equipment that can be accessed to suit most beach types / required clean-up operations. Trained Santos personnel can be quickly mobilised to appropriate locations using helo. services or vessels, followed by AMOSC staff and AMOSC Core Group from Perth. Equipment and trained personnel are not expected to be limiting factors for this response strategy. Seven potential additional or improved control measures were identified and assessed. All were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations such as Port Hedland, Karratha or Exmouth • Pre-purchase and storage of additional equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations such as Port Hedland, Karratha or Exmouth • Access to additional shallow draft vessels owned by Santos to transport personnel to key sensitive areas on offshore islands • Access to additional team leaders that are locally based at strategic locations (e.g. Port Hedland, Karratha or Exmouth) or can be mobilised within short time frames • Faster access to clean-up personnel via Perth based labour hire contractor • Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations • Faster access to clean-up personnel via Santos employment of local personnel Performance standards and measurement criteria that have been developed for the in effect and accepted control measures are shown in Section 13.6 . The key areas of effectiveness for the identified control measures, during times of preparedness, relate to maintaining access to suitable equipment and personnel through contractual arrangements. During response, a key area of effectiveness is the rapid mobilisation of equipment and personnel and preparation of a Shoreline Clean-up Sub-plan and operational NEBA to ensure that impacts from response activities are minimised and operations are conducted in accordance with protection priorities as confirmed by the Control Agency.
Oiled Wildlife Response
Santos has developed the Santos Oiled Wildlife Response Framework Plan as a control measure to ensure that a procedure is in place for OWR, where Santos is the Control Agency or Support Organisation, in order to provide an effective and coordinated OWR. Oiled wildlife equipment, including first strike kits and containers, can be mobilised from regional locations and Perth. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst-case oiled wildlife operations identified in the OPEP. The availability of trained personnel in the initial stages of an incident is a limiting factor for this response strategy.

ALARP assessment summary
Two additional, alternative or improved potential control measures were identified and assessed, however both were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Pre-hire and/or prepositioning of staging areas and responders • Direct contracts with service providers Performance standards and measurement criteria that have been developed for the in effect and accepted control measures are shown in Section 15.5. The key areas of effectiveness for the identified control measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, the mobilisation of requirements for initial oiled wildlife response operations and the management of the oiled wildlife response in accordance with the WA Oiled Wildlife Response Plan are both key elements for achieving this strategy.
Operational and Scientific monitoring
Oil spill operational and scientific monitoring will be conducted on behalf of Santos by contracted OSM Service Provider, via the OSM Supplementary Services Agreement as detailed in the North West Shelf OSM-BIP (7715-650-ERP-0002). Four additional, alternative or improved control measures were identified and assessed, but were rejected as grossly disproportionate to the potential reduction in environmental risk: • Operational and Scientific monitoring personnel, plant and equipment on standby at the operational location • Ensure trained monitoring specialists are available on site • Just-In-Time training to train personnel for spill response roles • Ensure trained marine mammal/fauna observers based at strategic locations such as Port Hedland, Karratha and Broome. Performance standards and measurement criteria that have been developed for the in effect and accepted control measures are show in Section 16.1. The key areas of effectiveness for the control measures during times of preparedness, are around maintaining contracts for operational and scientific monitoring services and annual reviews of the OSM Bridging Implementation Plans.
Waste Management
The Santos contract with the waste service provider has provisions for waste management operations of the scale estimated to be required in worst-case scenarios detailed in the OPEP. Further detail is captured in the Waste Management Plan – Oil Spill Response Support (SO-91-IF-10053). The waste service provider can mobilise waste receptacles from Karratha within 24hours. Given the waste service provider arrangements and preplanning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. Areas of improvement were identified regarding the availability of vessels required for waste transport at sea and additional storage tanks. Four potential additional, alternative or improved Control Measures were identified and assessed to reduce these risks. One Control Measure was accepted as reasonably practicable. • Monitoring and hire of additional vessels located in the region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal), and contracted at the time of incident Three additional, alternative or improved Control Measures were rejected as grossly disproportionate to the potential reduction in environmental risk: • Maintain contracts with multiple service providers • Procure temporary waste storage for Santos stockpile • Contract additional vessels on standby for waste transport Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Section 17.6. The key areas of effectiveness for the identified control measures, during times of preparedness, relate to maintaining access to waste management equipment and services through contractual arrangements. During response, a key area for increasing effectiveness is the timely mobilisation of requirements for initial response operations and defining critical management and reporting services to be provided by the waste service provider.

ALARP assessment worksheets

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Source Control – Adopted control measures in Section 9.6							
Relief well drilling	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract / MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts. Limit/prevent hydrocarbon contacting sensitive receptors	This primary source control measure provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintenance of contracts / MOUs	**In effect**
	Contract source control personnel through an alternative provider in addition to existing arrangements	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	**Not Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** - No environmental benefit in having access to personnel surplus to requirements
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for relief well drilling by Santos Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintaining document	**In effect**
	MODU Capability Register is monitored monthly	In effect	Procedure	By monitoring MODU availability in the region, it will be possible to gain an understanding of which MODU may be rapidly available for relief well operations. This could reduce MODU mobilisation times thus reducing volume of hydrocarbons released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with monitoring MODU availability	**In effect**
	Relief well design assessment to identify and screen relief well spud locations prior to cessation of production activities	In effect	Procedure	Reduce time taken to plan and execute relief well and reduce environmental impacts	Improved availability and reliability	**Feasible** Cost associated with conducting a relief well design assessment	**In effect**
Source Control – Vessel Collision	Vessel Spill Response Plan (SOPEP/SMPEP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Vessel Contractor thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Cost associated with due diligence checks on contractor procedure.	**In effect**
Surface well kill	Direct Surface Intervention Via Well Control Experts	In effect	Procedure	Reduce time taken to control source and reduce environmental impacts	1) Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. 2) Mobilisation procedure for personnel as per Source Control Planning and Response Guideline (DR-00-OZ-20001) 3–4) Contracts and MoUs for well control personnel (WWC)	Ability to implement and effectiveness of this control can only be determined at the time of an incident.	**In effect** Santos has a standing agreement with Wild Well Control for call-out of well control experts. Arrangements already in place to access resources (Source Control Planning and Response Guideline (DR-00-OZ-20001), Contracts) but this control will be applied opportunistically and will be dependent upon safety constraints.
Monitor and Evaluate – Adopted control measures in Section 10.6							
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of contract	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	The service provider will be contacted immediately (within 2 hrs) from IMT call-out. Upon activation, the service provider will provide trajectory models within: • 2 hours for OILMAP model for offshore and open ocean • 4 hours for OILMAP operations for near-shore • Detailed modelling service is available for the duration of the incident.			reducing and mitigating environmental impact	Area of improvement; none identified		
	Access to additional spill modelling capability through OSRL	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	An additional service provider ensures redundancy (independence) if for some reason the other service provider was unable to fulfil the function or additional capability is needed. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	**Feasible** Cost of membership	**In effect**
	Purchase of oil spill modelling system and internal Santos personnel trained to use system	Alternative	System / People	This could result in the faster generation of the initial model which may result in an environmental benefit as a consequence of the IMT making operational decisions quicker	Potentially increases availability Decrease in functionality; in house service may not be across technical advances to same extent as contracted service providers	**Feasible** Purchase of system, training of personnel, and on-call roster	**Reject** The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2-hour turnaround currently guaranteed by the service provider.
Tracking buoy	Level 1: 4 tracking buoys available from Varanus Island within 24 hours. 2 tracking buoys available from Exmouth. Vessel transit time for Exmouth - Distance from Exmouth to Reindeer is 180nm (18 hours at 10 knots	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**In effect**
	Level 1: Santos owns and maintains 10 x tracking buoys across its NW facilities.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**In effect**
	Level 2: Tracking buoys available from AMOSC and through AMOSC Mutual Aid. Transit times (road freight): Perth to Exmouth ~15 hrs	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**
	Level 3: Tracking buoys available from OSRL. Transit times (air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**
	Santos purchase additional satellite tracking buoys	Additional	Equipment	There is no expected environmental benefit from having	Increase in availability and reliability	**Feasible**	**Reject**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
				additional tracking buoys, as there are already tracking buoys located across Santos NW facilities ready for deployment 24/7 and any additional needs can be provided by these Santos owned stocks. Additional buoys can be accessed from AMSA, AMOSC and OSRL within days with no additional upfront cost.		Cost of purchasing additional tracking buoys	Does not provide any additional environmental benefit and the cost associated is therefore not warranted.
Aerial surveillance – aircraft and crew	Maintain contract with service provider for dedicated aerial platform operating out of Karratha. Helicopter services available through Santos primary contracted supplier. Activation of aerial surveillance using helicopter pilots will occur in 3 hours of notification of the spill. Helicopter on site for surveillance within 6 hrs. Surveillance and recording using helicopter pilots is considered adequate for situational awareness.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of contract	**In effect**
Aerial surveillance – observers	Level 1: Trained Santos aerial observers will be available from Day 2 of the incident, following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of training and maintaining trained staff	**In effect**
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders. Available from Day 2 of the incident.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of AMOSC membership	**In effect**
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2–3 days, remaining personnel available from 4–5 days, subject to approvals/clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of OSRL membership	**In effect**
	Ensure trained aerial observers based at strategic locations such as Exmouth, Port Hedland and Karratha	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1 (current arrangements are that the helicopter pilot would provide the initial observations and recording on Day 1 with trained aerial observers from Perth and VI mobilised and operational by Day 2).	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** Cost is considered disproportionate to the incremental benefit given surveillance on Day 1 by pilots is considered sufficient
Aerial surveillance – unmanned aerial vehicles	Level 2: Unmanned Aerial Vehicle for aerial surveillance available through AMOSC (UAV and pilots can be accessed through AMOSC with a mobilisation time of <48 hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given their ability to assess more difficult areas.	Provides functionality and availability Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft)	Provides functionality and availability Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
				given their ability to assess difficult areas.			
Vessel surveillance	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	In effect	Procedure	Provides the procedure for interaction and sighting of protected marine fauna from vessel or aircraft to ensure compliance with EPBC Regulations.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of maintaining and implementing procedure	**In effect**
	Level 1: Vessels already on hire and in use in WA and located at (or in transit to) Exmouth, Dampier or Varanus Island could be used for surveillance purposes in the event of a spill. The Santos IMT begins sourcing Santos contracted vessel or VOO for on-water surveillance within 90 minutes from IMT call-out. Santos has access to on-hire vessels supporting WA's VI and NV facilities. WA Vessel Monitoring System (IHS Maritime Portal) has access to automatic identification system (AIS) live-vessel tracking portal to establish vessel availability.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provides localised close-up observation.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Monitoring and hire of additional vessels located in the region tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through the existing Master Service Agreements.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provides localised close-up observation.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**
	Level 3: Vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provides localised close-up observation.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of contracts at the time of requirement.	**In effect**
Satellite Imagery	Maintain membership with AMOSC provider to enable access and analysis of satellite imagery	In effect	Systems	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Maintain membership with OSRL provider to enable access to and analysis of satellite imagery	In effect	System	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
Mechanical Dispersion - Adopted control measures in Section 11.3							
Mechanical Dispersion	Use of vessel crews, contract vessels and vessels of opportunity to disperse small areas of amenable hydrocarbon types such as marine diesel.	In effect	People / Equipment	Enhanced dispersion and biodegradation of released hydrocarbons.	Provides availability, reliability, survivability,	**Feasible** - Cost associated with vessel hire	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
				The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass and macroalgae).	compatibility and independence. Limited functionality as mechanical dispersion is a secondary response strategy limited by weather conditions, hydrocarbon type and hydrocarbon volume.	- Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission are not suitable.	
	No alternate, additional or improved control measures identified						N/A
Protection and Deflection – Adopted Control measures in Section 12.4							
Protection and deflection-booms and ancillary equipment	Level 2: Shoreline and nearshore booms plus ancillary equipment from: Varanus Island (Santos, 4*Beach Guardian, 8*25 m Zoom Boom, 1*skimmer), Exmouth (AMOSC, 20*25 m Beach Guardian, 19*25 m Zoom Boom, 6* skimmers), Santos 2*Beach Guardian, 5*25 m Zoom Boom, 1*skimmer Dampier (AMSA, 5* Canadyne Inflatable, 10* Structureflex Inflatable, 5* Versatech Zoom Inflatable, 2 Slickbar Solid Buoyancy, 3*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Fremantle (AMOSC, 19*25 m Beach Guardian, 34*25 m Zoom Boom, 1* HDB 1500 Boom, 18* Curtain Boom, 9*skimmer; AMSA, 15*Structureflex Inflatable, 13*Versatech Zoom Inflatable, 10*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Broome (AMOSC, 4*25 m Beach Guardian boom, 8*25 m Zoom boom, 2*HDB 1300 boom, 1*skimmer). Vehicles sourced from local hire companies. Transit times (vessel): • Varanus Island to Dampier = 7 hrs • Varanus Island to Exmouth = 18 hrs • Exmouth to Lowendal Island = 12 hrs • Exmouth to Montebello Islands = 13 hrs • Exmouth to Barrow Island = 10 hrs Transit times (road) • Fremantle to Exmouth = ~24 hrs • Fremantle to Karratha/Dampier = ~24 hrs • Exmouth to Dampier/ Karratha= 7 hrs • Exmouth to North West Cape = 0.5 hr. Protection booming equipment mobilised to FOB location within 24 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of booms, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs associated with equipment purchase and maintenance Costs of contracts, MOUs with AMOSC and AMSA	**In effect**
	Level 3: Shoreline and nearshore booms plus ancillary equipment from Geelong (AMOSC), interstate (AMSA) and Singapore (OSRL). Transit times (road/air) Geelong or Singapore to Exmouth or Karratha = 3–5 days. These resources in place to commence protection and deflection within 3–10 days.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs associated with equipment purchase and maintenance Costs of contracts, MOUs Costs associated with staff training	**In effect**
	Santos to purchase additional shoreline and nearshore booms and ancillary equipment	Additional	Equipment	Enable more protection and deflection operations to occur simultaneously to protect more key areas	Improved availability and reliability	**Feasible**	**Reject** Protect and deflect is a secondary response strategy for the LOWC scenario, given the modelling

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
						Costs associated with equipment purchase and maintenance	predicts floating oil will not reach 50 g/m^2 and there is no shoreline accumulation predicted at or above the response threshold (100 g/m^2). Sufficient quantities of equipment located in the region.
Protection and deflection-vessels	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Island. Boom deployment vessel / remote island transfer vessel mobilised to FOB location / deployment port within 24 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription)	**In effect**
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Maintain a list of small vessel providers that could be used for nearshore booming	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of maintaining a list of small vessel providers	**In effect**
	Access to additional shallow draft boom tow vessels owned by Santos	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas.	Improved availability and reliability	**Feasible** Costs of vessel purchase and maintenance	**Reject** Protect and deflect is a secondary response strategy for the LOWC scenario, given the modelling predicts floating oil will not reach 50 g/m^2 and there is no shoreline accumulation predicted at or above the response threshold (100 g/m^2). High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
Protection and deflection-personnel	Level 2: Spill responders from Varanus Island, Devil Creek, Perth (Santos), Fremantle (AMOSC), Perth (AMOSC Core Group). Santos Offshore Core Group mobilised to Exmouth within 24 hrs. AMOSC Staff and Industry Core Group mobilised to deployment port location within 24–48 hrs.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Availability – Santos access to helo services ensures that regional personnel can be quickly mobilised to the appropriate location. Area for improvement; none identified	**Feasible** Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff, 12 people), interstate (AMOSC Core Group, up to 84 people;	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities	Provides functionality, availability, reliability,	**Feasible**	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	AMSA National Response Team, unspecified) and international (OSRL, 18 people). Interstate staff available from 2–3 days. OSRL staff initial 5 technical advisors available from 2–3 days, remaining personnel available from 4–5 days, subject to approvals/ clearances.			Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	survivability, compatibility and independence Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	
	Ensure trained personnel based at strategic locations such as Dampier, Karratha or Exmouth	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** No Santos personnel currently based at Karratha or Exmouth so employment costs would be significant and not justified given that helicopters enable rapid transportation of Santos staff within the region.
Protection and deflection-planning	Regional shoreline sensitivity and access data/maps and TRPs for key locations	In effect	Procedures	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of document preparation and maintenance	**In effect**
Shoreline Clean-up – Adopted control measures in Section 13.6							
Shoreline Clean-up – equipment	Level 2: Manual clean-up and flushing equipment from: Varanus Island (Santos WA, 1*container) Fremantle (AMOSC, 2*Boom Accessories Beach Guardian Deployment kit, 1*flushing kit) State hardware outlets. Decontamination/staging equipment from: Karratha (AMSA; 2*decon stations) Fremantle (AMOSC, 1*decon kit; AMSA, 2* decon stations). Mobile plant from state hire companies. PPE from: Exmouth and Varanus Island (Santos WA, 2*containers) Fremantle (AMOSC, 1*decon kit, 2*gas detectors). Transit times (vessel): • Varanus Island to Dampier = 7 hrs • Varanus Island to Exmouth = 18 hrs • Exmouth to Lowendal Island = 12 hrs • Exmouth to Montebello Islands = 13 hrs • Exmouth to Barrow Island = 10 hrs Transit times (road) • Fremantle to Exmouth = ~24 hrs • Fremantle to Karratha/Dampier = ~24 hours • Exmouth to Dampier/ Karratha= 7 hrs • Exmouth to North West Cape = 0.5 hr. Clean-up equipment mobilised to deployment port location <48 hours	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – procurement and mobilisation of equipment	**Feasible** Cost of membership with AMOSC Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	Resources in place to commence shoreline clean-up within 60–72 hours (weather/daylight dependent)						
	Level 3: Manual clean-up and flushing equipment from: Geelong (AMOSC, 1*shoreline support kit, 2* flushing kits, 1*shoreline impact lance kit) Singapore (OSRL) and national hardware outlets. Decontamination/ staging equipment from: Geelong (AMOSC, 1*decon kit). Mobile plant sourced from national hire companies. PPE from Geelong (AMOSC, 1*container, 4*gas detectors). Transit time (road/ air) • Geelong or Singapore to Exmouth or Karratha = 3–5 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – procurement and mobilisation of equipment	**Feasible** Cost of membership with AMOSC and OSRL Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**
	Mechanical mobile plant equipment for clean-up pre-purchased and positioned at strategic locations (Exmouth)	Additional	Equipment	Environmental benefits and impacts are dependent on hydrocarbon fate and local ecology. Reduced mobilisation times and improved access would assist, should mobile plant be deemed advantageous.	Improved availability and reliability	**Feasible** Costs associated with equipment purchase and maintenance	**Reject** Shoreline clean-up is a secondary response strategy for the LOWC scenario, given the modelling predicts no shoreline accumulation predicted at or above the response threshold (100 g/m^2). There is a high likelihood that mobile plant equipment is not used due to negative environmental impacts, leaving purchased equipment unutilised and costs disproportionate. Locally available hire plant can be used. Additional plant could be mobilised from Perth if required.
	Pre-purchase and storage of equipment (decontamination/staging equipment, clean-up and flushing, PPE) at strategic locations (e.g. Exmouth, Dampier)	Additional	Equipment	Improve mobilisation time, potential for more response locations	Improved availability and reliability	**Feasible** Cost in purchase and maintenance of equipment	**Reject** Equipment for first strike available at Exmouth. Additional equipment can be mobilised from Dampier.
Shoreline Clean-up – vessels	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Island. Remote island transfer vessel mobilised to deployment port location within 24 hrs.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas on offshore islands	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas on offshore islands	Improved availability and reliability	**Feasible** Costs of vessel purchase and maintenance	**Reject** Shoreline clean-up is a secondary response strategy for the LOWC scenario, given the modelling predicts no shoreline accumulation predicted at or above the response threshold (100 g/m^2). High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
Shoreline Clean-up personnel	Level 2: Clean-up team leaders from Varanus Island, Devil Creek, Perth (Santos WA), Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Offshore Core Group mobilised to deployment port location within 24 hrs. AMOSC Staff and Industry Core Group mobilised to site/deployment port location within 48 hrs.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Costs associated with staff training. Costs of membership, MoU with AMOSC, AMSA through the National Plan.	**In effect**
	Level 3: Clean-up team leaders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international (OSRL). Interstate staff available from 2–3 days. OSRL available from 2–3 days, remaining personnel available from 4–5 days, subject to approvals/ clearances.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – rapid mobilisation of personnel	**Feasible** Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	**In effect**
	Access to additional team leaders that are locally based at strategic locations (e.g. Exmouth, Dampier) or can be mobilised within short time frames.	Additional	People	Improve mobilisation time, potential for more response locations.	Improved availability and reliability.	**Feasible** Cost of employment and training of staff Cost of being locally based or on a rapid mobilisation plan	**Reject** Santos WA already employs trained oil spill responders in the region that can be mobilised to key areas by helicopter
	Access to clean-up labour personnel (predominantly based in Perth).	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Costs of labour hire through existing service provider	**In effect**
	Faster access to clean-up personnel via Perth based labour hire contractor	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Not Feasible** Not feasible to mobilise labour hire personnel in less than 72 hours	**Reject** Shoreline clean-up is a secondary response strategy for the LOWC scenario, given the modelling predicts no shoreline accumulation predicted at or above the response threshold (100 g/m^2).

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
							Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Not Feasible** No identified regional labour hire companies	**Reject** Shoreline clean-up is a secondary response strategy for the LOWC scenario, given the modelling predicts no shoreline accumulation predicted at or above the response threshold (100 g/m^2). Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	Faster access to clean-up personnel via Santos employment of local personnel	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Feasible** Costs associated with personnel employment and training	**Reject** Shoreline clean-up is a secondary response strategy for the LOWC scenario, given the modelling predicts no shoreline accumulation predicted at or above the response threshold (100 g/m^2). Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial phase of response.
Shoreline Clean-up – planning	Shoreline sensitivity mapping and Tactical Response Plans (TRP) for key locations	In effect	Procedures	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – rapid mobilisation in initial 48 hours of incident	**Feasible** Cost associated with development and maintenance of mapping and Tactical Response Plans	**In effect**
Shoreline Clean-up response	Prioritise use of existing roads and tracks	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities, improve response time and efficiency			**In effect**
	Soil profile assessment prior to earthworks	In effect	Procedures	Improved baseline information for shoreline condition			**In effect**
	Pre-cleaning and inspection of equipment (quarantine)	In effect	Procedures	Reduced potential for contaminating environment during response activities			**In effect**
	Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	In effect	Procedures	Improved capacity to respond appropriately to areas of potential cultural significance			**In effect**
	Select temporary base camps in consultation with DoT and DBCA	In effect	Procedures	Optimise response based on camp location, reduce environmental impact of camps			**In effect**
	Shoreline Response Programme Manager assessment/selection of vehicle appropriate to shoreline conditions	In effect	Procedures	Improved response efficiency			**In effect**
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			**In effect**
	Stakeholder consultation	In effect	Procedures				**In effect**
Oiled Wildlife Response – Adopted control measures in Section 15.5							
Oiled wildlife response – planning	Implementation of the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan	In effect	Procedure	Working within the guidelines of the WAOWRP and Pilbara OWRP will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement- framework for how Santos will integrate with Control Agencies for OWR	**Feasible** Effort and time involved in developing OWR implementation plan within OSCP based on guidance from WAOWRP and Pilbara OWRP	**In effect**
	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017); sets the corporate guidance for OWR preparedness and response and defines how Santos will integrate with Control Agencies to provide a coordinated response	In effect	Procedure	The framework is complementary to the WAOWRP and Pilbara OWRP and facilitates a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR.	Improved functionality and reliability	**Feasible** Cost of document development and maintenance	**In effect**
Oiled wildlife response – equipment	Level 2 OWR kits and containers available from AMOSC, AMSA, DBCA or DoT in Exmouth, Broome, Karratha, Fremantle or Kensington. WA equipment mobilised to Exmouth region forward staging area within 48 hrs from oiled wildlife contact (predicted or observed).	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) • Singapore to Exmouth = 3–5 days.	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
Oiled wildlife response – personnel	Level 1/2 Santos personnel trained in OWR. OWR trained personnel mobilised to Exmouth region within 24 hrs from oiled wildlife contact (predicted or observed)	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; ensure personnel are based not just in the Perth Office but also at VI and DC facilities	**Feasible** Cost of training and maintaining training	**In effect**
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractor and Industry Mutual Aid. Mobilisation of OWR personnel to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement – availability – rapid mobilisation of personnel in initial 48 hours of incident	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3 OWR personnel available through OSRL. OSRL have 5 technical advisors initially available within 2–3 days, remaining personnel available within 4–5 days, subject to approvals/clearances.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of membership with OSRL	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
					Area of improvement; none identified		
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel to receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost of labour hire at time of incident	**In effect**
	Additional Santos OWR trained personnel positioned at VI and Perth	In effect	People	Additional personnel trained in OWR and whom are located at facilities will enhance the first strike capability of Santos and therefore enhance the likelihood of success of the OWR.	Improved functionality, availability, reliability and independence.	**Feasible** Cost of training staff	**In effect**
	Pre-hire and/or pre-positioning of staging areas and responders	Additional	System	This may enhance response times and first strike capability and hence improve the likelihood of success of the OWR. Conversely, pre-positioned personnel and staging areas may result in negative impacts to the environment and wildlife. The common operating picture (COP) and operational NEBA will inform the best response strategies at the time of the spill event.	Improved functionality, availability, reliability and independence.	**Feasible** Additional wildlife resources could total $1,500 per operational site per day. This is a guaranteed cost regardless of whether a spill occurs or not.	**Reject** The cost of setting up staging areas and having responders on standby is considered disproportionate to the environmental benefit gained. Further, pre-positioned personnel and staging sites may have negative impacts on the environment and wildlife. The overall OWR capability Santos can access through Santos staff, AMOSC, AMOSC mutual aid, Santos labour force hire arrangements, DBCA and wildlife carer network are considered adequate, with further advice and international resources available through OSRL.
	Direct contracts with service providers	Alternative	System	This option duplicates the capability accessed through AMOSC and OSRL and would complete for the same resources without providing a significant environmental benefit	Does not improve effectiveness	**Feasible** Cost of contract	**Reject** This option is not adopted as the existing capability / contractual arrangements meets the anticipated need.
Waste Management – Adopted control measures in Section 17.6							
Waste Management	Waste management sourced through contract with waste service provider. Contract with waste service provider maintained and periodically reviewed. Waste receptacles mobilised from Karratha within 24 hrs for containment and recovery, protection and deflection and shoreline clean-up response strategies.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	**Feasible** Cost of contract	**In effect**
	Maintain contracts with multiple waste service providers	Additional	System	Contract with additional waste service provider will not provide an additional environmental benefit as there are two major service providers in the region and reciprocal arrangements facilitate access to equipment of both.	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** Capacity of existing arrangements exceeds the worst-case resourcing requirements.
	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	**Feasible** Costs of contracts, MOU with waste service provider, AMOSC and OSRL, access to National Plan Resources through AMSA	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Additional cost in purchase and maintenance of tanks	**Reject** Capacity of existing arrangements exceeds the worst-case resourcing requirements. Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA and OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commencing.
	Vessels for waste transport through Santos contracted providers. To minimise vessel decontamination requirements, larger vessel will remain on station whilst smaller vessel will transport waste to Dampier or Exmouth.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	**Feasible** Cost of contract with vessel providers	**In effect**
	Monitoring and hire of additional vessels located in the region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal). Vessels contracted at the time of incident (i.e. no master services agreement already in place).	Additional	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility.	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of requirement.	**Accept**
	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of waste, particularly greater capacity for containment and recovery in the initial 2-5 days of response	Provides functionality, availability, reliability, survivability, compatibility and dependence	**Feasible** Cost in contracting vessels to remain on standby for incident waste requirements	**Reject** Capacity of existing arrangements exceeds the worst-case resourcing requirements. Expense of maintaining vessels on standby that are surplus to day-to-day requirements is disproportionate to environmental benefit. Santos is accustomed to coordinating logistics for tasks around finite resources. Santos monitors vessel availability through Santos Vessel Tracking System. Regularly contracted vessels could be supplemented with vessels of opportunity.
Operational and Scientific Monitoring – Adopted control measures in Section 16.1							
Operational & Scientific Monitoring (OSM) service provider and equipment	Maintenance of contract for operational and scientific monitoring services (OSM) and annual review of OSM Bridging Implementation Plans (BIPs). OSM Service Provider and monitoring equipment mobilised to site 72 hrs from OSM Activation.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of contract with Operational and Scientific Monitoring (OSM) Service Provider	**In effect**
	Regular capability reports from OSM Services Provider shows personnel availability and annual reviews OSM BIPs	In effect	System	This ensures the SMSP has the capability to undertake scientific monitoring, including, post-spill pre-impact surveys within the Scientific Monitoring Planning Area	Improves functionality, availability and reliability	**Feasible** Cost of contract with OSM Service Provider	**In effect**

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
				of receptors with deficient baseline data.			
	Conduct periodical review of existing baseline data sources across the Santos combined Scientific Monitoring Planning Area	In effect	System	This ensures that receptors within the Scientific Monitoring Planning Area with deficient baseline data are identified	Improves functionality and provides compatibility	**Feasible** Cost of contract with OSM Service Provider	**In effect**
	Operational and Scientific monitoring personnel, plant and equipment on standby at the operational location	Additional	People / Equipment	Improve mobilisation time	Improved availability and reliability	**Feasible** Cost would be in excess of $1 mil. annually	**Reject** Cost of control measure is disproportionate to the environmental benefit
	Maintain equipment list and list of suppliers for implementation of Operational and Scientific Monitoring Plans	In effect	Procedure	Improve response time	Improved functionality, availability and reliability	**Feasible** Cost of contract with OSM Service Provider	**In effect**
	Oil sampling kits for operational and scientific monitoring personnel to be positioned at Varanus Island, Exmouth and Dampier	In effect	Equipment	Improve response time	Improved availability and reliability	**Feasible** Cost associated with purchase of equipment and maintenance	**In effect**
Operational and Scientific Monitoring – vessels	Level 2: Hire of vessels located in the region tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement. Santos to mobilise monitoring vessels to deployment location within 72 hrs from OSM activation	In effect	Equipment	Improve response time	Provides availability and reliability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**In effect**
	Level 3: Vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Procedure	Improve mobilisation time	Increase in availability and reliability	**Feasible** Cost to determine vessel specifications	**In Effect**
Operational & Scientific Monitoring (Water Quality Monitoring)	Maintain water quality monitoring services through OSM Supplementary Services contract with OSRL. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hours of OSM activation.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	**Feasible** Cost of contracts with OSM Service Provider	**In effect**
	Access to additional guidance and in-field support for water quality monitoring through AMOSC	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	**Feasible** Cost of OSRL membership	**In effect**
	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Procedure	Improve mobilisation time	Improved availability and reliability	**Feasible** Cost to determine vessel specifications	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
	Purchase of first strike oil/water quality monitoring kits to be positioned at Exmouth and VI. Technical procedure for sample collection developed (Santos Oil and Water Sampling Procedures – 7710-650-PRO-0008).	In effect	Equipment / Procedure	Will enable oil fingerprinting and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	**Feasible** Cost of purchasing equipment and developing procedure	**In effect**
	Trained monitoring specialists on standby at site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	**Feasible** Costs associated with staff employment	**Reject** This is not necessary as a procedure for sample collection is in place (Santos Oil and Water Sampling Procedures – 7710-650-PRO-0008)
Operational & Scientific Monitoring (Shoreline Assessment)	Level 1/2: WA-based AMOSC staff and core group operations personnel (WA industry has arrangements through AMOSC to mobilise shoreline assessment team leader personnel to site 24–72 hours from time of shoreline contact prediction)	In effect	People / Procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of AMOSC membership	**In effect**
	Level 3: Maintain membership with OSRL to access SCAT trained responders (OSRL, 18 people). OSRL staff initial 5 technical advisors available from 2–3 days, remaining personnel available from 4–5 days, subject to approvals/clearances.	In effect	People / Procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts.	Provides additional functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of OSRL membership	**In effect**
	Just-In-Time training to train personnel for spill response roles	Additional	People	Greater capacity for shoreline clean-up assessment in the later stages of response	Improved availability and reliability, lower dependence	**Feasible** High cost of training at the time of requirement. Minimum shoreline contact window of opportunity to train workforce is limited. Trainees require minimal prior skills and will be easily sourced.	**Rejected** Existing resources are sufficient to resource the response requirements.
Operational and Scientific Monitoring (Wildlife Reconnaissance – aerial/vessel surveillance, shoreline and coastal habitat assessment)	Maintain contract with operational and scientific monitoring service provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys through OSM Supplementary Services contract with OSRL.	In effect	People / Procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability – reduce time to mobilise personnel to strategic locations	**Feasible** Cost of contract	**In effect**
	Maintain a list of providers that could assist with fauna aerial observations, e.g. whale shark spotting planes	In effect	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of developing and maintaining list	**In effect**
	Ensure trained marine mammal/fauna observers based at strategic locations such as Port Hedland, Karratha and Broome	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained marine mammal/fauna aerial observers available from Day 1	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** Maintaining trained fauna observers at location is considered grossly disproportionate as they can be mobilised from scientific monitoring provider.

Appendix C Pollution report

Government of **Western Australia**
Department of **Transport**

Marine Pollution Report (POLREP)
MEER

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

BEFORE completing this form please contact the MEER duty officer on (08) 9480 9924 (24hrs). Immediate reporting will enable a rapid response.

Return completed form to:
Maritime Environmental Emergency Response
Department of Transport
Email: marine.pollution@transport.wa.gov.au and rccaus@amsa.gov.au
Phone (08) 9480 9924

INCIDENT DESCRIPTION

Incident Name: _____ Date and Time of Incident (24 hr format): _____

Location name/description: _____

Incident Coordinates: Latitude of spill _____ Longitude of spill _____

Description of Incident: _____

Weather conditions at site: _____

OIL DETAILS

Pollutant source

Amount of fuel/pollutant on board: _____

☐ Vessel ☐ Land (Specify) _____ ☐ Other (Specify) _____ ☐ Unknown

Vessel type (if known) ☐ Tanker ☐ Container ☐ Bulk ☐ Cargo

☐ Fishing ☐ Defence ☐ Recreational ☐ Other (Specify) _____

Vessel name: _____ Flag State / Callsign: _____ Australian vessel? ☐ Yes ☐ No

Pollutant

☐ Oil (type) ☐ Bilge ☐ Diesel ☐ HFO bunker ☐ Crude ☐ Unknown ☐ Other (Specify)_____

☐ Chemical Name: _____ MARPOL cat / UN Nos:_____

☐ Garbage Details/description: _____

☐ Packaged Details/description: _____

☐ Sewage Details/description: _____

☐ Other Details/description: _____

Extent

Size of spill (length & width in metres): _____

Amount of pollutant spilt, if known (litres): _____

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

☐ Photos taken Details: _____ held by:_____

☐ Video taken Details: _____ held by:_____

☐ Samples taken Description: _____ held by:_____

☐ Items retrieved Description: _____ held by:_____

To attach photos, this form must be opened in acrobat, or alternatively, photos can be attached to the submission email before sending.

ADDITIONAL INFORMATION

Response action undertaken? ☐ Yes ☐ No If yes, provide details below, please include any environmental impact.

Equipment used? ☐ AMSA ☐ State ☐ Industry

Is assistance for an investigation required from DoT ☐ Yes ☐ No

KEY CONTACT DETAILS

Name:_____ Position: _____ Phone: _____

Control Agency: Select the Control Agency _____ Jurisdictional Authority: Select the Jurisdictional Authority _____

PRIVACY STATEMENT

The Department of Transport is collecting the information on this form to enable it to carry out its role as Jurisdictional Authority as per State Hazard Plan - Maritime Environmental Emergency.
The Department of Transport and/or AMSA may give some or all of this information to other government bodies, non-government organisations who have responsibilities under the National Plan, and law enforcement agencies.

Pollution Report (POLREP)		
Reporter's Signature:		
Name:	Agency:	Role:

Once you have completed the form please check that all relevant fields have been filled with accurate data.
Please email completed form to marine.pollution@transport.wa.gov.au

Appendix D Situation report

Government of **Western Australia**
Department of **Transport**

Maritime Environmental Emergency Situation Report (SITREP)
MEER

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

Return completed form to:
Maritime Environmental Emergency Response
Department of Transport
Email: marine.pollution@transport.wa.gov.au and rccaus@amsa.gov.au
Phone (08) 9480 9924

MARITIME ENVIRONMENTAL EMERGENCY SITUATION REPORT (SITREP)

This is advice from the Control Agency of the current status of the incident and the response.
This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

INCIDENT DESCRIPTION

Incident Name: _____ Ref. No. _____

Incident Controller: _____

Incident Declaration Level: Please select _____ Controlling Agency: Please select _____

Priority ☐ Urgent ☐ Immediate ☐ Standard

Final SITREP? ☐ Yes ☐ No

Next SITREP on: _____

Date and Time of Incident (24 hr format): _____

POLREP or AMSA Form 18 Reference : _____

Incident location: _____ Latitude: _____ Longitude: _____

Brief description of incident and impact: _____

Overall weather conditions: _____

Summary of response actions to date: _____

Current Strategies: _____

Summary of resources available/deployed:_____

Expected developments: _____

Other Information:_____

Maritime Environmental Emergency Situation Report (SITREP)		
Reporter's Signature:		
Name:	**Agency:**	**Role:**

Once you have completed the form please check that all relevant fields have been filled with accurate data.
Please email completed form to marine.pollution@transport.wa.gov.au

Appendix E Vessel surveillance observer log

Vessel Surveillance Observer Log – Oil Spill

Survey Details			
Date	Start time:	End Time:	Observers:
Incident:			Area of Survey:
Vessel:			Master:

Weather Conditions	
Wind speed (knots):	Wind direction:
Time high water and height (LAT):	Current direction:
Time low water and height (LAT):	Current speed (nM):
Tide during observations:	Sea state:
Stage of tide during observations (incoming/falling):	Other weather observations:

Slick Details											
Slick grid parameters by lat/long:					Slick grid parameters (vessel speed)			Slick grid dimensions: N/A			
Length Axis:		Width Axis:			Length Axis: N/A			Width Axis	Length		nm
Start Latitude		Start Latitude			Time (seconds)			Time (seconds)	Width		nm
Start Longitude		Start Longitude							Length		nm
End Latitude		End Latitude			Speed (knots)			Speed (knots)	Width		nm
End Longitude		End Longitude							Grid area		km^2
Code	Colour	%age cover observed	Total grid area		Area per oil code			Factor	Oil volume		
1	Silver			km^2		km^2		40-300 L/ km^2		L	
2	Iridescent (rainbow)			km^2		km^2		300-5,000 L/ km^2		L	
3	Discontinuous true oil colour (Brown to black)			km^2		km^2		5,000-50,000L/ km^2		L	
4	Continuous true oil colour (Brown to black)			km^2		km^2		50,000 – 200,000 L/ km^2		L	
5	Brown / orange			km^2		km^2		>200,000 L/ km^2		L	

Timeline of observations:

Time	Description

Appendix F Aerial surveillance observer log

Santos

Aerial Surveillance Observer Log – Oil Spill

Survey Details				
Date:	Start time:	End Time:	Observer/s:	
Incident:			Area of Survey:	
Aircraft type:	Call sign:		Average Altitude:	Remote sensing used:

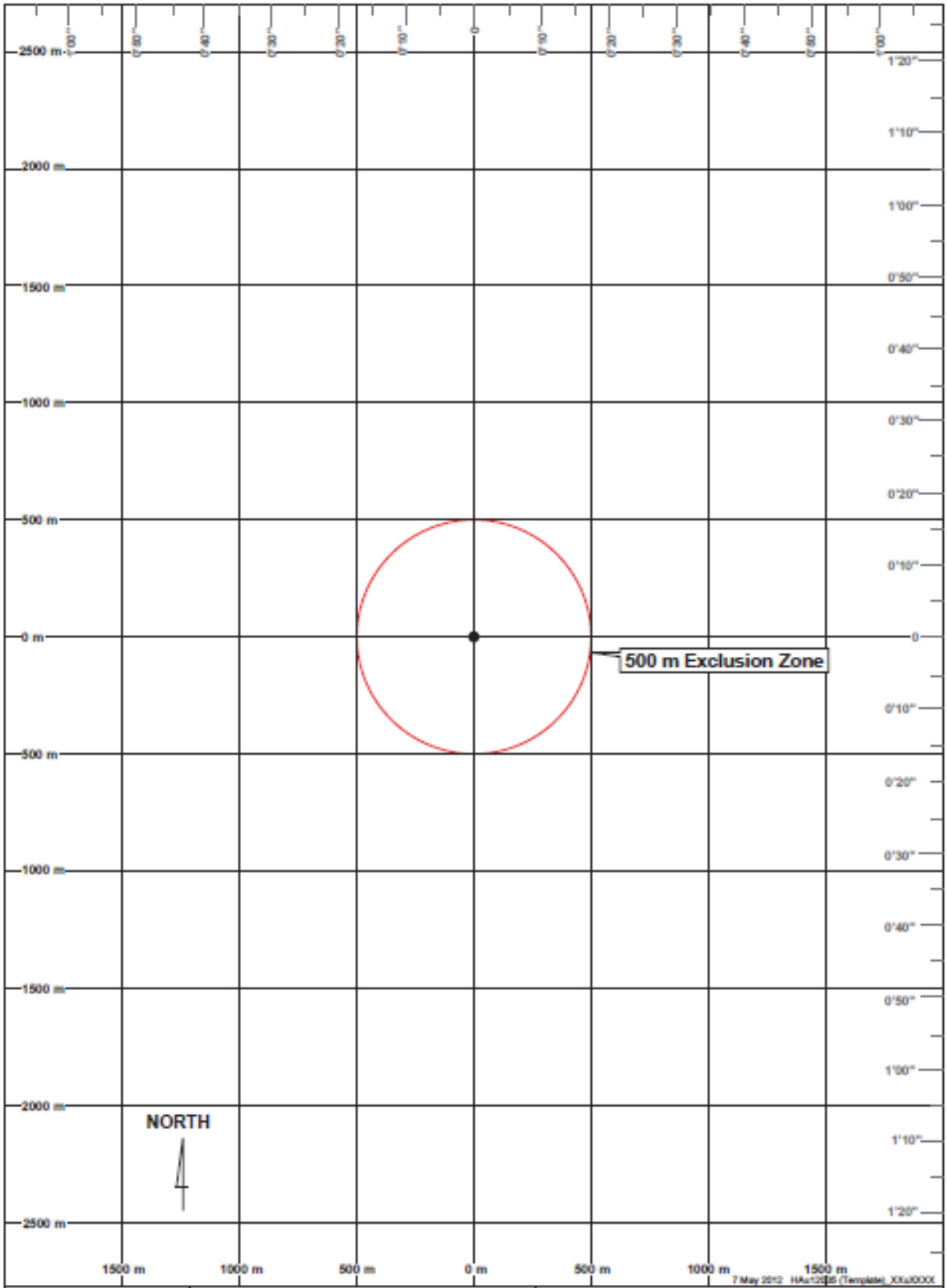
Weather Conditions	
Wind speed (knots)	Wind direction
Cloud base (feet)	Visibility
Time high water	Current direction
Time low water	Current speed (nM)

Slick Details											
Slick grid parameters (lat/long)				Slick grid parameters (air speed)		Slick grid dimensions					
Length Axis		Width Axis		Length Axis		Width Axis	Length	nm			
Start Latitude		Start Latitude		Time (seconds)		Time (seconds)	Width	nm			
Start Longitude		Start Longitude					Length	nm			
End Latitude		End Latitude		Air Speed (knots)		Air Speed (knots)	Width	nm			
End Longitude		End Longitude					Grid area	km^2			

Code	**Colour**	**% cover observed**	**Total grid area**		**Area per oil code**		**Factor**	**Oil volume**	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Appendix G Aerial surveillance surface slick monitoring template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



	NAME:	VESSEL / AIRCRAFT:
	DATE / HOUR:	OTHER REFERENCE:

Appendix H Aerial surveillance marine fauna sighting record

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

Date:		**Time:**	
Latitude:		**Longitude:**	

MARINE FAUNA ID GUIDE

○ Humpback whale

○ Blue whale

○ Minke whale

○ Sperm whale

○ Killer whale

○ Bryde's whale

○ Whale species unknown

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Leatherback turtle

○ Turtle species unknown

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**Behaviour / Comments.** **Proximity to oil? Oiled?** **Milling? Feeding? Transiting?**
Cetaceans (Whales/ Dolphins)					
Turtles					
Birds					
Dugongs					
Sharks					
Other					

Other details for each observation location

WEATHER DETAILS

Sea State ◯ Mirror calm ◯ Small waves ◯ Slight ripples ◯ Large waves some whitecaps ◯ Large waves, many whitecaps

Visibility ◯ Excellent ◯ Good ◯ Moderate ◯ Poor ◯ Very Poor

OBSERVER DETAILS

Observer Name	Observer signature	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I Aerial surveillance shoreline observation log

Aerial Surveillance Reconnaissance Log – Oil Spill

Survey Details				
Incident:	Date:	Start time:	End Time:	Observer/s:

Area of Survey	
Start GPS LATITUDE: LONGITUDE:	End GPS LATITUDE: LONGITUDE:

Aircraft type	Call sign	Average Altitude	Remote sensing used (if any)

Weather Conditions		
Sun/Cloud/Rain/Windy	Visibility	Tide Height L/M/H
Time high water	Time low water	Other

Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present					
	Rocky Cliffs		Boulder and cobble beaches		Sheltered tidal flats
	Exposed artificial structures		Riprap		Mixed sand and gravel beaches
	Inter-tidal platforms		Exposed tidal flats		Fine-Medium sand grained beaches
	Mangroves		Sheltered rocky shores		Other
	Wetlands		Sheltered artificial structures		

Operational Features (tick appropriate box)					
	Direct backshore access		Alongshore access		Suitable backshore staging
Other					

Appendix J Shoreline clean-up equipment

Table J-1: Recommended equipment for an initial deployment of a 6-person shoreline clean-up team

Shore clean-up Tools	Quantity
Disposal Bag Labelled, 140 cm x50cm x 100µm	1,000
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	50
Polyethylene Safety Shovel 247mm z 978mm	2
Steel Shovel	4
Steel Rake	2
Landscapers Rake	2
Barrier Tape – “Caution Spill Area”	10
Pool scoop with extendable handle – flat solid	2
Poly Mop Handle	2
Safety Retractable Blade Knife	2
Poly Rope 20m	6
Star Pickets	24
Star Picket driver	1
Hand Cleaner	1
Cable ties – general use	1,000
Wheel Barrow	2
Galvanised Bucket	4
Pruning secateurs	2
Hedge Shears	1
Personal Protection Equipment (PPE) – Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Respirator dust/mist/fume and valve	40
Disposable box light nitrile gloves (100bx)	2
Alpha Tec gloves (assort size)	24
Ear Plugs (200bx)	1
Safety Glasses	18
Safety Goggles non vented	6
Gum Boots (assort size)	18
Rigger Gloves (assort size)	18
Day/Night Vest	6
Storage Equipment	
Collapsible Bund 1.6m x 1.2m	2
Collapsible bund 4m x 2.4m	1
Misc. sizes of ground sheets / tarps.	6
Absorbents	
Absorbent Roll ‘oil and fuel only’ 40m x 9m	6
Absorbent Pad “oil and fuel only” 45cm x 45cm	400
Poly Mops (snags)	150
Poly Absorbent Wipes	10
Additional Items	
Folding Deck Chair 6	6
Folding Table 1	1
Shelter open side 1	1
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6
Boxes, Bin and Lid Storage/transport assorted	-
Optional items	
Inflatable tent 9 square metres	1

Table J-2: Recommended equipment list for a decontamination unit for a shoreline clean-up team

Shore clean-up Tools	Quantity
Inflatable Decon Tent	1
Inflatable Tent 9 square metres – Modesty or Control tent	1
Misc sizes of ground sheets/tarps	4
Collapsible Bund 1.6m x 1.2m (two stages)	2
2 stools in each bund	4
Collapsible Bund 4m x 2.4m (for used PPE and clothing into DB's)	1
Long Handled Scrub brush	2
Scrub Brush	2
Simple Green 20 ltr	2
Poly Absorbent Wipes	10
Wet Wipe Canister	6
Disposal Bag for Clothing, 140cm x 50cm x 100µm	100
Bath towel	6
Liquid soap in push dispenser (citrus based)	1
Track mat – Absorbent for Corridor/walkway	1
Star pickets	16
Star picket driver	1
Barrier tape to create corridors	4
Safety Goggles non vented (used during decon)	6
Additional items	
Folding Deck Chair	6
Folding Table	1
Shelter open side	1
6 Person first aid kit	1
Wide Brim Hat with cord	6
Sunburn Cream 1 litre pump bottle	1
Personal Eyewash bottle 500mls	6
Personal Drink bottle 750mls	6
Boxes, Bin and Lid Storage/transport assorted	-

Table J-3: Recommended equipment list for deployment of a 6-person team for shoreline flushing or recovery

Flushing Equipment	Quantity
Diesel self prime semi trash pump, 25-35 psi, 4.8hp	1
Perforated 2" lay flat hose, 20 m sections	2
Section Hose 2", 20m sections	5
Hose End Strainer	1
Recovery Equipment	
Tidal Boom (shoreline boom) 25m lengths	2 (50m)
Tidal Boom Accessories pack 1	1
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section 2 (50m)	2 (50m)
Towing Bridle 2	2
Danforth Sand Anchor Kit, 30m lines, 15m trip lines 3	3
Diesel Powered pump with hose 1	1
Manta Ray skimmer 1	1
Personal Protection Equipment (PPE) – Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Respirator dust/mist/fume and valve	40
Disposable box light nitrile gloves (100 box)	2
Ear Plugs (200 box)	1
Safety Glasses	18
Gum Boots (assorted sizes)	18
Hyflex Oil Restraint Gloves (assorted sizes)	18
Day/Night Vest	6
Storage Equipment	
Collapsible Bund 1.6m x1.2m	1
Misc sizes of ground sheets/tarps	6
Collapsible Tank 5,000 litres	2
Absorbents	
Absorbent Boom 'oil and fuel only' 3 or 6m x 180,mm	200 m
Absorbent Roll 'oil and fuel only' 40m x 9m	10
Absorbent Pad "oil and fuel only" 45cm x 45cm	1,000
Poly Absorbent Wipes	10
Additional Items	
Folding Deck Chair	6
Folding Table	1
Shelter open side	1
6 Person first aid kit	1
Wide Brim Hat with cord	6
Sunburn Cream 1 litre pump bottle	1
Personal Eyewash bottle 500mls	6
Personal Drink bottle 750mls	6
Boxes, Bin and Lid Storage/transport assorted	-
Inflatable Tent 9 square metres	1

Table J-4: Recommended equipment list for a 6-person team for near shore clean-up

Absorbents	Quantity
Absorbent Roll ‘oil and fuel only’ 40m x 9m	20
Absorbent Pad “oil and fuel only” 45cm x 45cm	2,000
Absorbent Boom “oil and fuel only” 3or6m z 180mm	200 m
Poly Mops (snags)	150
Poly Absorbent Wipes	20
Recovery Equipment	
Tidal Boom (shoreline boom) 25m lengths	4 (100 m)
Tidal Boom Accessories pack	2
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	8 (200 m)
Towing Bridle	2
Danforth Sand Anchor Kit 15kg 30m lines, 15m trip lines	10
Weir Skimmer 30T hr	1
Trash Screen for above	1
Diesel Powered pump with hose	1
Manta Ray skimmer	1
Shore Clean-up Tools	
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	200
Pool scoop with extendable handle – flat solid	2
Poly Mop Handle	2
Poly Rope 20m	10
Star Pickets	24
Star Picket driver	1
Intrinsic Safe Torch	6
Hand Cleaner	1
Cable ties (to add extra join to absorbent booms)	150
Personal Protective Equipment (PPE) Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Disposable box light nitrile gloves (100 box)	2
Alpha Tec gloves (assorted sizes)	24
Ear Plugs (200bx)	1
Safety Glasses – with head strap	18
Gum Boots (worn extra large or as advised by skipper)	18
Steel cap waders	2
Personal Flotation Device	6
Rigger Gloves (assort size)	18
Storage equipment	
Collapsible Bund 1.6 m x 1.2 m	2
Collapsible bund 4 m x 2.4 m	1
Collapsible Tank 5,000 litres	2
Alum box, Bin & lid Storage/transport cases	10
Misc. sizes of ground sheets/tarps	6
Additional Items	
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6

Appendix K Shoreline response strategy guidance

Guidance on response methods for sensitive coastal habitats is provided in Table K-1.

Guidance on applicable shoreline clean-up techniques based on shoreline substrate and degree of oiling are presented in Figure K-1 to Figure K-4.

Table K-1: Strategy Guidance for shoreline response at coastal sensitivities

Sensitive receptors	Strategy guidance
Mangroves	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of creeks or along the mangrove fringe to prevent/minimise oiling. • Sorbents can be used to wipe heavy oil coating from roots in areas of firm substrate. Close supervision of clean-up is required. • Where thick oil accumulations are not being naturally removed, low-pressure flushing may be attempted at the outer fringe – sorbent pads and sorbent sweeps can be used to recover the sheen. • No attempt should be made to clean interior mangroves, except where access to the oil is possible from terrestrial areas. • Oily debris should be removed; it is extremely important to prevent disturbance of the substrate by foot traffic; thus most activities should be conducted from boats. • Live vegetation should not be cut or otherwise removed.
Mudflats	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of channels filling/ draining mudflats. • Efforts to manually clean mudflats may result in further damage due to trampling of the oil into sediments which typically rich in biota and provide a food source for fish and birds. • Therefore, natural remediation may be the preferred approach and if removal is required, the flushing of oil into open water, if feasible, may be preferred to manual collection • The presence of wildlife (e.g. shorebirds) and sensitive flora (e.g. mangroves) which are often associated with mudflats needs to be considered in determining the best approach.
Sandy beaches	• Clean-up techniques will depend upon the degree of infiltration into sand or and degree of burial which will require surveying/mapping • Clean-up will also depend upon sensitivity of environment (existing ecological features), access to the beach and potential for additional erosion. • Oil and oiled sediments can be physically removed offsite, moved to surf zone for surf washing of sediment or assisted to move to water edge by ploughing of channels or flushing. • Recovery of oil can be by manual means (hand tools) or mechanical means (earth moving, pumping equipment). • The sensitivity of the environment is a key factor, with manual removal creating less waste and disturbance but more consuming in time and resources.
Seabirds, shorebirds and migratory waders	• All efforts should focus on deflecting oil away from this area or dispersing the oil offshore or using booms offshore to divert the oil away from this area. • If oil is expected to move into the coastal colonies and roosting areas, multiple booms can be deployed along the reserve to prevent/minimise oiling.
Turtle nesting beaches during or near nesting season	• All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. • However, if oil is expected to move into this area, booms can be deployed along the reserve to prevent/minimise oiling.
Fringing coral reef communities	• Little can be done to protect coral reef beds along exposed sections of shoreline. • Floating oil would potentially coat living reef communities, which are usually slightly elevated and are consequently exposed at low tide.

Sensitive receptors	Strategy guidance
(Note: submerged coral reef communities are less susceptible to oiling)	• Natural recovery with a close monitoring program is the preferred clean-up technique. Clean-up of the reef itself by natural processes is expected to be rapid. • As much as practicable, oil should be removed from adjacent intertidal areas to prevent chronic exposure of the corals to oil leaching from these sites. • Use of sorbents should be limited to those that can be contained and recovered.
Macroalgal and seagrass beds	• All efforts should focus on deflecting oil away from this area, dispersing the oil offshore, or using booms to divert the oil away from this area. • Extreme care should be taken not to disturb the sediments during clean-up operations in the vicinity of macroalgal and seagrass beds, which could result in total loss of the macroalgal and seagrass beds. • Removal of oiled parts of the macroalgal and seagrass beds should only be considered when it can be demonstrated that special species are at significant risk of injury from contact or grazing on the macroalgal and seagrass beds. • Otherwise, the best strategy for oiled seaweed is to allow natural recovery.
Rocky coast	• Where practicable, booms can be deployed parallel to the rocky coasts to prevent/minimise oiling. • Flushing rocky shoreline is considered the most effective method of cleaning. Care must be taken to assess the fate and transport of the flushed oil and sorbent snares can be used to recover if deemed necessary to reduce impacts to ALARP. • For small areas of contamination, rocky structure can be manually wiped with sorbent pads or scraped to remove oil.

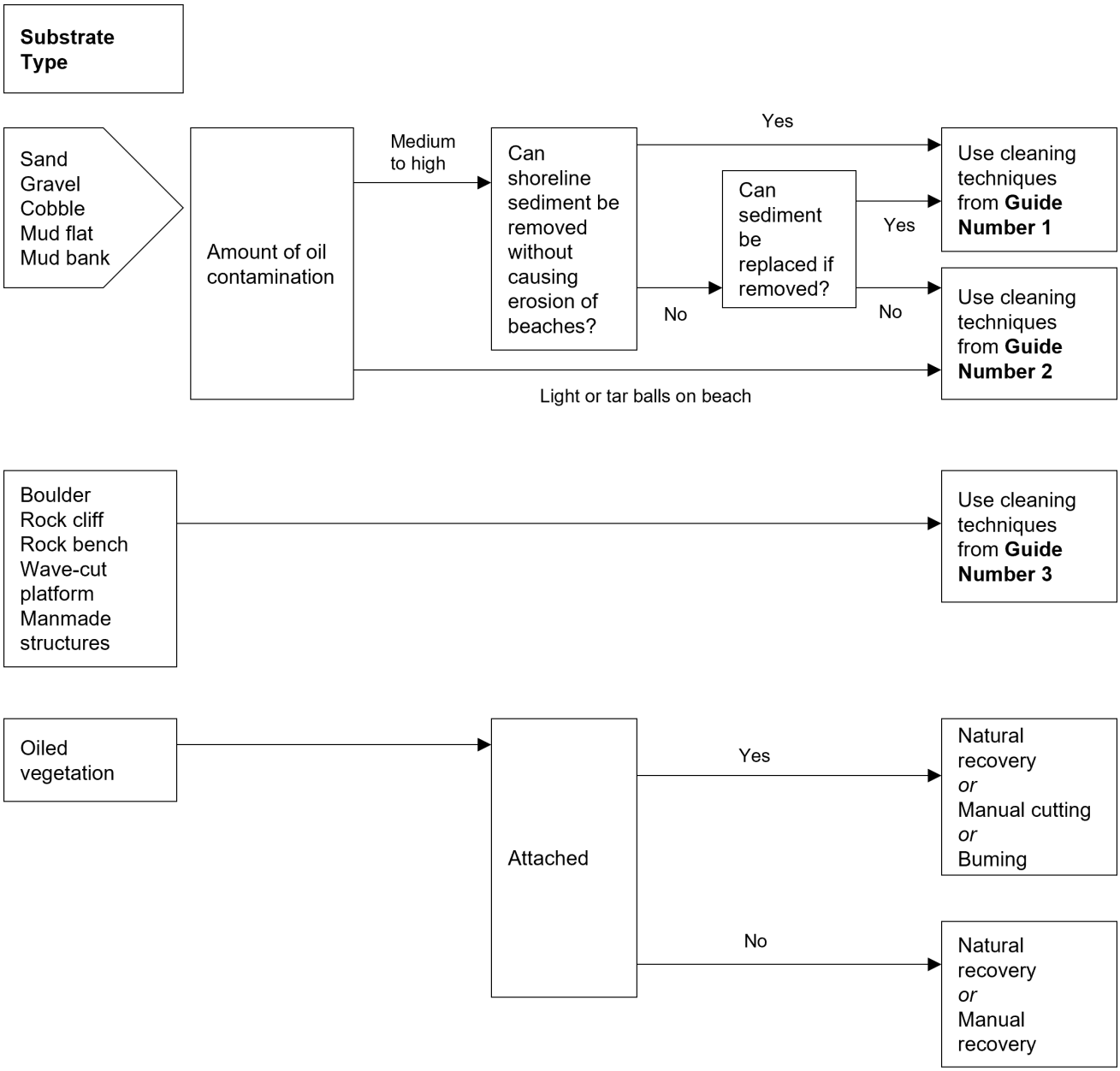


Figure K-1: Shoreline Clean-up Master Decision Guide

Trafficability		Substrate type	Depth of penetration	Clean-up techniques in order of preference	Access	
1. Can rubber-tyred equipment operate on beach?	→ Yes	Sand, Gravel. Mud	Less than 3 cm	Motor-grader and elevated scraper combination. Elevated Scraper, Motor-grader and Front-end loader (Rubber-tyred) combination.	**3. Is there access to beach for heavy equipment or can access be constructed?**	→ Yes ↓ Select most preferable technique
			Greater than 3 cm	Elevated Scraper. Front-end loader (Rubber-tyred). Bulldozer and Front-end loader (Rubber-tyred) combination.		
		Cobble	Less than 30 cm	Front-end loader (Rubber-tyred).		
			Greater than 30 cm	Bulldozer and Front-end loader (Rubber-tyred) combination. Front-end loader (Rubber-tyred).		
		Mud bank	Not applicable	Backhoe. Front-end loader (Rubber-tyred).		
↓ No						
2. Can tracked equipment operate on beach?	→ Yes	Sand, Gravel, Mud, Cobble	Less than 30 cm	Front-end loader (Tracked). Bulldozer and Front-end loader (Tracked) combination.		
			Greater than 30 cm	Bulldozer and Front-end loader (Tracked) combination. Front-end loader (Tracked).		
↓ No					↓ No	
Use dragline or hydraulic grader or leave to natural recovery				Go to next Figure – Decision guide No. 2, Question 4.		

Figure K-2: Shoreline Clean-Up Decision Guide 1

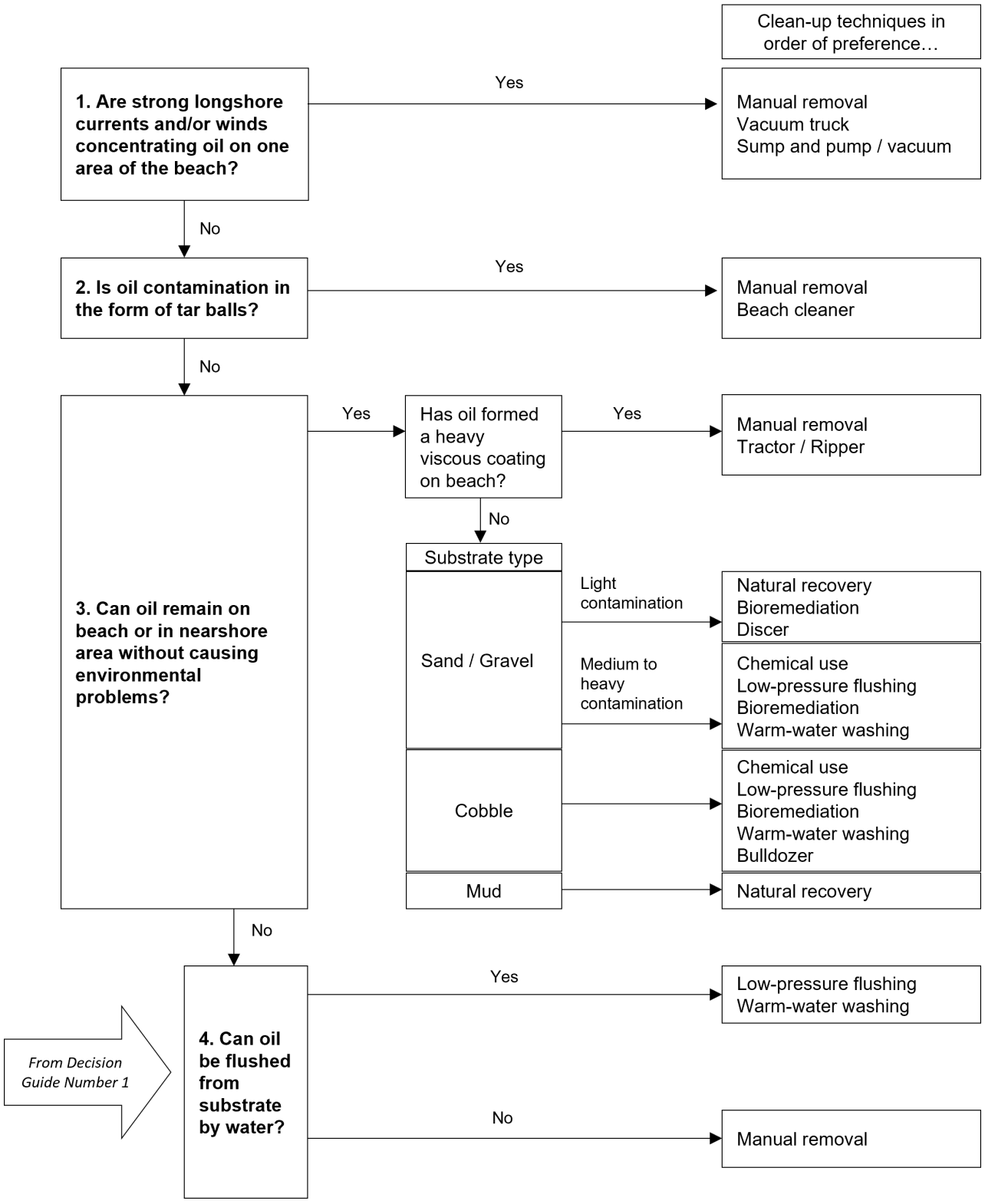


Figure K-3: Shoreline Clean-Up Decision Guide 2

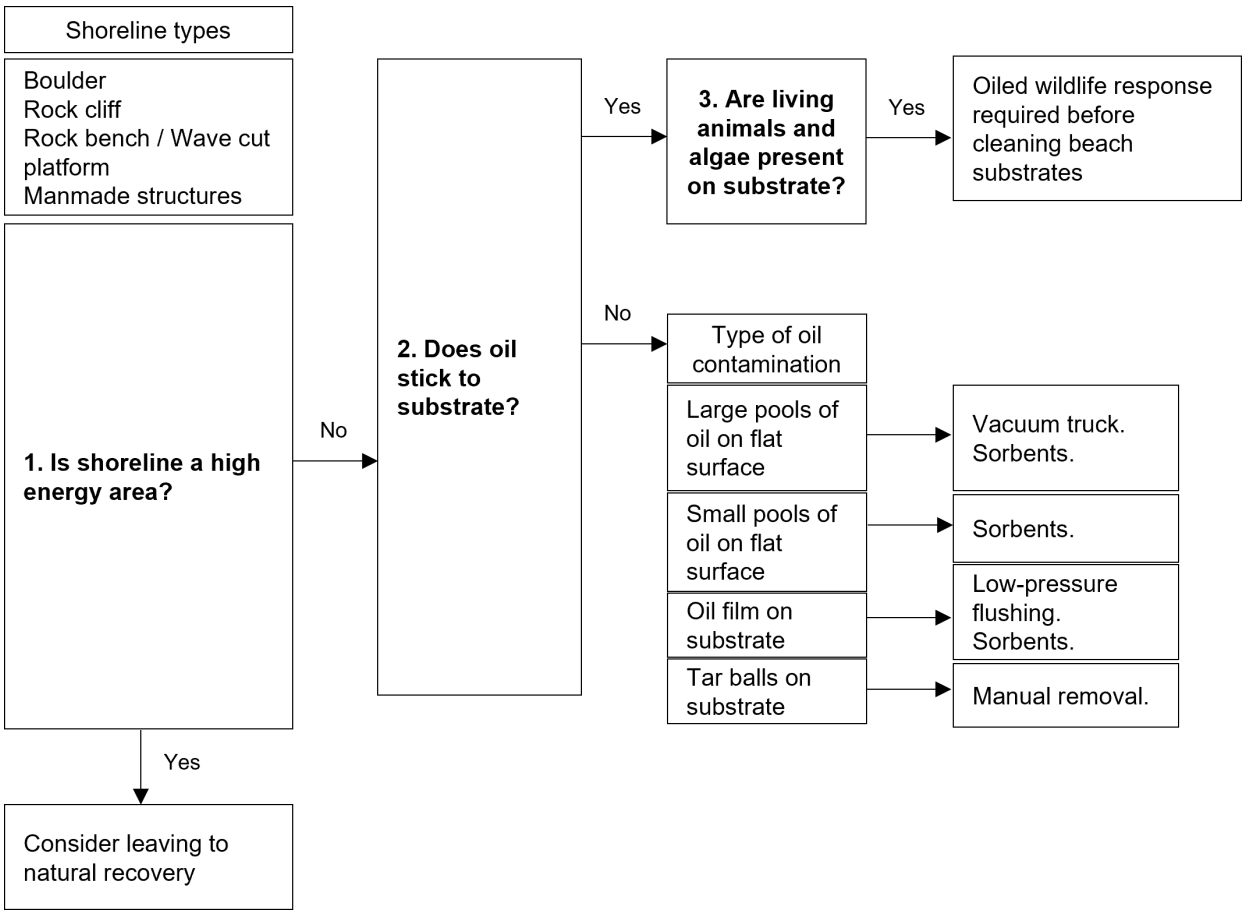


Figure K-4: Shoreline Clean-Up decision Guide 3

Appendix L Operational guidelines for shoreline response

L-1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
  - Provide an extinguisher for each cabin
  - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
• Plastic liners, geotextiles • Barrier tape and stakes • Signposting equipment	• Bins, barrels, skips, tanks • Hot and cold beverages Welfare) • Cooking oil, soap (Welfare) • Earthmoving equipment

Primary Storage of Waste

A primary storage site is:

- An emergency staging area of the immediate deposit of the waste collected before its transfer to either an intermediate long term storage site or if possible directly to a treatment facility; and
- A key stage in the waste management process for sorting, labelling and quantifying the types and volumes of waste collected and when possible, reducing volumes to be transported by pre-treatment.

The storage site must be closed as soon as clean-up operations are completed.

The return of the site to its original condition implies:

- A contamination diagnosis made by an organisation specialised in ground pollution, decontamination operations if needed and the approval of the authorities; and
- In some cases, botanical evaluations to define a plant cover restoration operation.

- Segregate the different types of waste
- Protect containers from rain water and to contain odours
- Protect containers from prolonged exposure to sunlight if necessary
- Ensure security to prevent unauthorised dumping

Primary waste storage sites should meet certain criteria:

- Close proximity to the site of clean-up;
- Good access to roads for heavy lorries; and
- A flat area with enough space away from environmentally-sensitive areas (vegetation, groundwater) and out of reach of the sea tides and waves.

- Depending on the volume of waste, site characteristics and availability of containers, prepare:
  - Staging areas
  - Pits if necessary
  - Platform within earth berms
  - Platform for bagged solids and liquids in tank.
- Protect areas using watertight plastic liners
- Lay fine gravel or sand at the base of the storage area to protect the membranes
- Prepare rain water or effluent management
- Ensure correct labelling of the containers to avoid mixing the different types of waste (liquid, solid, non-biodegradable – oiled plastics, contaminated cleanup equipment, biodegradable – oiled seaweed, faunal)
- Control access to the cleanup sites and protect access routes using lining and/or geotextiles

Base Camp / Rest Area

The rest area (base camp) should at least consist of:

- Changing rooms;
- Toilets; and
- A rest area.

At base camp, operators must be provided with:

- A first aid kit; and
- Hot and cold beverages, meals.

Selection of the rest area must meet certain criteria:

- Close proximity to the clean-up site;
- Easy access; and
- A flat area with enough space away from environmentally sensitive areas.

Equipment

- Shelter/rest area (tent, temporary building;
- Portable toilets (at least one for men and one for women);
- Locker rooms;
- First aid kit;
- Fire extinguisher; and
- Communication equipment.

Storage Area for Equipment and Machinery

This area consists of and equipped repair and maintenance site.

In order to avoid incidents and clean-up equipment failures, equipment should only be used by trained personnel and all equipment should regularly be checked for conformity with standard operating procedures and safety.

- Check and adjust daily levels of gasoline, diesel, oil, water and other fluids
- Regularly maintain the machines (pumps, pressure washers...)
- Equipment must be checked, counted by the person in charge of logistics and stored daily at the end of the work day
- Some pieces of equipment must be washed or at least rinsed daily, with proper recovery of cleaning effluent, other kinds of equipment should be washed weekly or at the end of operations
- Set up a systematic maintenance-cleaning-repair operation at the end of each week
- Small tools and equipment and even detachable parts of all equipment remaining outside should be securely stored away (eg stainless steel bucket of small sand screeners)
- In case of interruption of operations, large pieces of equipment should be moved to a supervised site
- Regularly check equipment for conformity and safety

The storage area for equipment and machinery must meet certain criteria:

- Close proximity to the site of clean-up;
- Easy access; and
- A flat area with enough space away from environmentally-sensitive areas.

Equipment

- Cabins;
- Hut;
- Maintenance equipment and tools; and
- Cleaning equipment.

L-2 Manual clean-up guidelines

Oil, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.

Conditions of use

- Pollution : all types ; most often scattered pollution; on large spills, if implementation of other techniques is impossible;
- Pollutant : all types;
- Substrate : all types; sufficient load bearing capacity for pedestrians and light equipment; and
- Site: all types sufficiently accessible and which tolerate intensive traffic.

Equipment

Basic Equipment:

- Scrapers (paint scrapers, long handle scrapers...), rakes, brushes, forks; and
- Landing nets, shovels, trowels.

Extra Equipment:

- Waste containers, big bags, bins, plastic bags; and
- Front-end loader (for disposal).

PPE: At least protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, expose and responder activity.

- Divide the response personnel among three functions:
  - Collection/scraping/gathering
  - Placing in bags/waste containers
  - Disposal
- Rotate the teams among the three functions;
- The waste can be disposed of manually or with the use of mechanical means if possible;
- Don’t overfill bins, plastic bags; and
- Don’t remove excessive quantities of sediments.

Impact

- Impact insignificant to heavy, depending on the type of substrate. Risk of destroying the structure of the substrate in marshes. Erosion;
- Potentially destructive effects on vegetation (dunes, marshland);
- Deconstruction and destabilisation of the foot of the dune (upper end of beach); erosion, destruction of the dune and the associated vegetation, decrease in biodiversity and fertility by reduction of the low water mark; and
- Can tend to fragment the oil in certain conditions.

Performance

This is a highly selective technique, but requires a lot of time and personnel. If not done correctly, there is a risk of removal of large quantities of clean sediment.

L-3 Mechanical clean-up guidelines

This technique consists of collecting the oil in order to facilitate its removal from the beach. Collection is carried out using a tractor, ATV or earthmoving vehicle or earthmoving equipment.

Conditions of use

- Pollution : heavy pollution, continuous slick;
- Pollutant : slightly to very viscous oil;
- Substrate : vast, flat foreshore with wet fine-grain sand (very damp to saturated) and a good load-bearing capacity, without ripple marks; and
- Site: accessible and sufficient load bearing capacity for earthmoving equipment, sufficiently large to allow vehicles to manoeuvre.

Equipment

Basic equipment:

- Backhoe loader;
- Grader/bulldozer;
- Tractor or loader with front blade; and
- Front-end loader or lorry (for removal).
- PPE: At least suitable for heavy machinery operation

Impact

- Normally only removes the oil, but some sediment may also be taken with it (if the operator is poorly supervised or inexperienced), especially if used on light pollution or an unsuitable site;
- High risk of disturbance due to traffic and mixing of oil with sediment; and
- May lead to reduction of beach stability and beach erosion/loss of beach area.

Minimum workforce required: 2 people per vehicle (1 drive + 1 assistant).

Waste: oil mixed with a varying quantity of sediment; but can rapidly become unselective if scraping is carried out on moderate pollution (should be avoided).

- Consists of bringing the oil together in order to facilitate its removal from the beach. Scraping is carried out using a tractor or earthmoving equipment fitted with a front end blade in an oblique position. According to the viscosity of the oil, two options are available:
  - (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
  - (case 2) more viscous oil /solids: concentration to form windrows, by successive slightly curing passes parallel to the water line; subsequent removal of windrows
- Should only be carried out on heavy pollution; do not use on moderate to light pollution
- Inform and supervise operators; use experienced operators
- Work methodically
- Set up traffic lanes on the beach in order to reduce oil and sediment mixing
- Don’t remove excessive amounts of non-contaminated materials
- Don’t fill the bucket of loader more than 2/3 capacity
- Don’t drive on polluted materials

L-4 Shoreline vessel access guidelines

There are numerous landing craft vessels available in the North West Shelf area. These vessels are capable of grounding out; therefore the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide. The Santos Offshore - Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) describes the specifications for beach landing craft, and describes Santos vessel monitoring processes.

Mechanical equipment and PPE are to be mobilised to the nominated marine operational base for onward movement to the affected locations.

For shoreline clean-up of remote islands, the following guidelines will be considered so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines:

Vessels are to be mobilised to the designated deployment Port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in 4 stages:

1) Drop off of 6-person clean-up containers to shoreline contact locations defined by IMT through observation data;
2) Deployment of marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary contamination impacts to flora and fauna by the clean-up teams;
3) Deployment of small clean-up teams with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-tide mark; and
4) Deployment of waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M Resourcing Requirements for OMP: Shoreline Clean-up Assessment

Shoreline clean-up assessment teams will comprise 2-3 members per team and are assumed to be able to cover 10 km per team per day. Teams may be able to exceed this distance, especially if remote sensing techniques (e.g. UAVs) are employed to cover shorelines that have access limitations, which includes many receptor locations in the EMBA and Scientific Monitoring Planning Area.

Santos has used stochastic modelling data for shoreline contact to plan for the worst-case shoreline and habitat assessment personnel requirements. Table M-1 presents all receptors contacted at ≥100 g/m² using the stochastic modelling results for scenario 6 (MDO spill resulting from a vessel collision at the HDD crossing) along with the SCAT planning considerations and estimated number of SCAT teams required. Scenario 6 had the greatest overall contact and length of oiled shoreline.

It should be noted that not all of the receptors listed in Table M-1 will be contacted by one single spill. These results are presenting the range of possible worst-case timeframes to contact and length contacted based on all runs that make up the stochastic model. Santos will use initial monitor and evaluate data (e.g. trajectory modelling and aerial surveillance) to determine where resources should be allocated. This may include directing resources to conduct SCAT at locations not identified as protection priority areas, to determine if protection and clean-up activities may be required at these receptors.

Initially, shoreline clean-up assessment may be conducted via reconnaissance surveys and later confirmed via ground and/or vessel surveys.

Table M-2 provides the resource capability available to Santos that may be used to implement SCAT.

Table M-1: Resource requirements for shoreline clean-up assessment for all shorelines contacted ≥100 g/m² based on stochastic results for the surface MDO spill resulting from a vessel collision at the HDD Crossing (scenario 6)

Location	Min. arrival time shoreline oil accumulation ≥100 g/m² (days, hours)	Max. length of shoreline oiled (km) ≥100 g/m²	Planning considerations	Estimated No. of teams required
Dampier Archipelago	4 days, 15 hours	3	Much of these coastlines are inaccessible to ground surveys. Survey teams would initially conduct reconnaissance surveys followed by targeted monitoring surveys to focus areas. Targeted monitoring surveys may be completed via vessel, and where possible, ground surveys.	1
Middle Islands Coast	NC	NA		1
Northern Islands Coast	2 hours	11		1

NC = No contact predicted

NA = Not applicable

Note: SCAT numbers not to be added up from this table as spill will not contact all receptors modelled (as these are stochastic results). Number of personnel required will be based on direction of spill and timeframes to contact.

Source: RPS (2024)

Table M-2: Shoreline clean-up assessment – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Shoreline assessment team leaders	Santos	12	Perth, Varanus Island	24-72 hours from time of shoreline contact prediction (WA-based, Santos personnel, AMOSC staff and Core Group personnel)
	AMOSC Core Group	As per monthly availability	Perth, Dampier and other Australian locations	
	AMOSC staff	12 trained in SCAT	Perth and Geelong	

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	OSRL	18	Perth and international	5 personnel available from 2–3 days, remaining personnel available from 4–5 days (subject to approvals/ clearances)
Shoreline assessment team members	Santos contracted work force hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)
Drones and pilots ** To assist shoreline and vessel-based surveillance	AMOSC	Drones available 24/7 through AMOSC sub-contract 1 x pilot	Fremantle	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12)
	OSRL – Third-Party UAV provider	2 x qualified remote pilots, however response is on best endeavours basis	Perth	Depending on the port of departure, 1–2 days if within Australia
	Local WA hire companies	10+	Perth and regional WA	<48 hours

Appendix N Operational and scientific monitoring capability

The North West Shelf OSM-BIP (7715-650-ERP-0002) defines the 3-step process for ensuring that OSM requirements of each activity are adequately covered by the existing information described within the North West Shelf OSM-BIP (7715-650-ERP-0002) (Section 1.1 and Appendix A of the North West Shelf OSM-BIP).

Step 1: Determine if the new activity Scientific Monitoring Planning Area fits within the North West Shelf OSM-BIP Combined Scientific Monitoring Planning Area

Comparison of the Scientific Monitoring Planning Area for Reindeer and Devil Creek activities (Figure N-1) shows that this fits within the North West Shelf OSM-BIP Combined Scientific Monitoring Planning Area (Figure 2-1 in the North West Shelf OSM-BIP). Figure 3-1 of the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations EP (7715-650-EMP-0023) also shows the Scientific Monitoring Planning Area for the four oil spill modelling scenarios referenced in that EP (refer to Table 6-1).

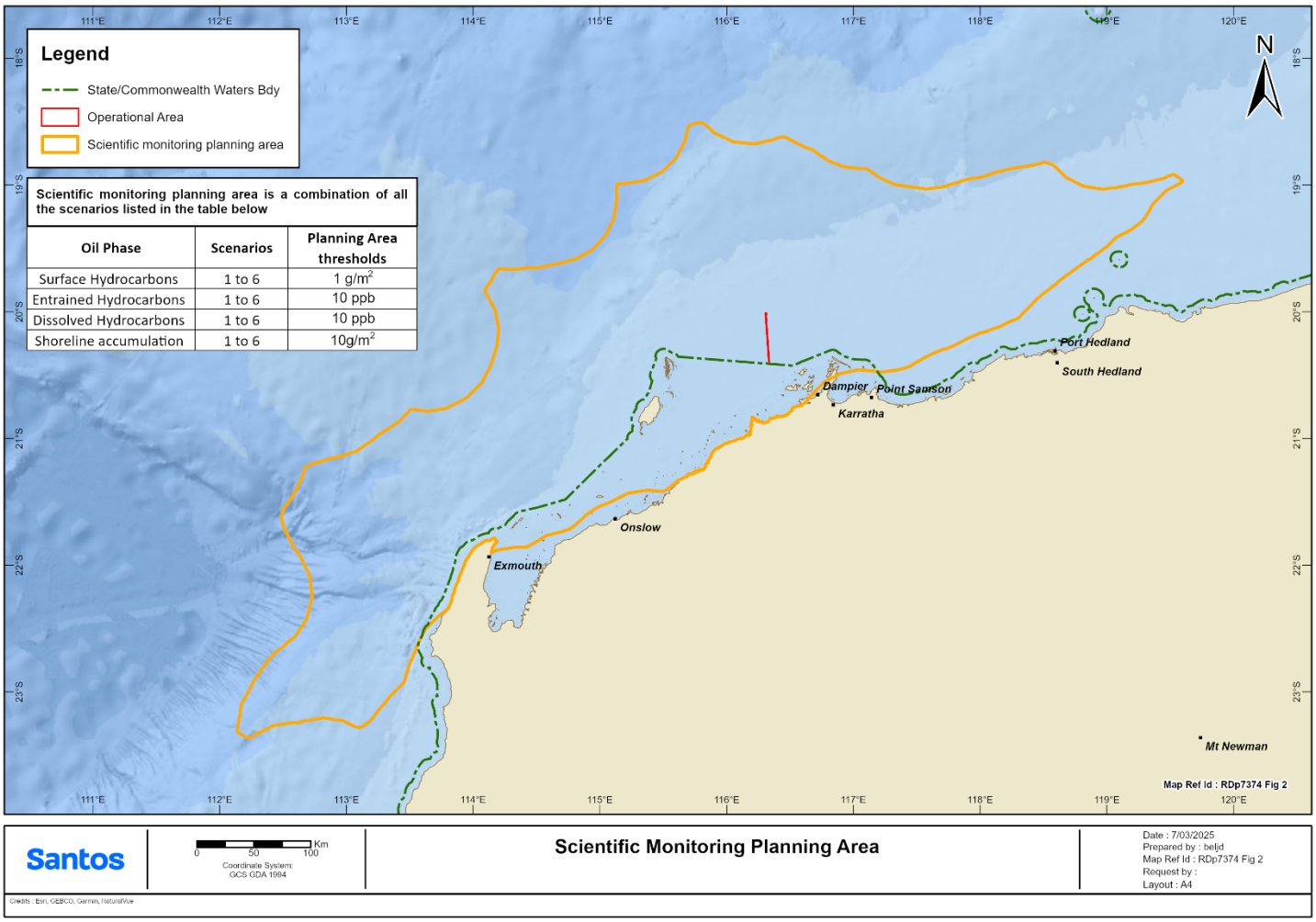


Figure N-1: Scientific Monitoring Planning Area for Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations EP (7715-650-EMP-0023) and the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations EP (onshore & State waters) (7715-650-EMP-0022-01)

Step 2: Determine the locations requiring a baseline review and whether these locations are currently included in the North West Shelf OSM-BIP

As per Section 2.2 of the North West Shelf OSM-BIP, receptors requiring a baseline data review were identified as those sensitive receptors contacted by hydrocarbons at the low threshold for floating (≥1 g/m^2), shoreline contact (≥10 g/m^2), entrained (≥10 ppb), and dissolved (≥10 ppb) within 7.0 days at a probability >5%.

The locations requiring a baseline data review for this activity are presented in Table N-1, and are included within Table 2-2 of the North West Shelf OSM-BIP.

Step 3: Determine whether the capability requirements and monitoring arrangements of the new activity exceed or are met by the capability requirements outlined in Section 8 and capability arrangements described in Sections 9 and 10 of the North West Shelf OSM-BIP.

As per the criteria outlined in Appendix A of the North West Shelf OSM-BIP, for the worst-case scenario (scenario 6 - MDO spill resulting from a vessel collision at the HDD Crossing [325 m^3]), two emergent receptors are contacted within 7 days at a probability of >5% (refer to Table N-1) using stochastic modelling. Therefore, the OSM capability requirements for Reindeer and Devil Creek activities are met by the worst-case capability requirements presented in Section 8 of the North West Shelf OSM-BIP. Therefore, additional deterministic modelling for Reindeer and Devil Creek activities is not required to inform OSM first-strike capabilities.

Table N-1: Reindeer and Devil Creek modelling results for locations with a probability of contact ≥5% and <7 days (RPS, 2024)

Scientific monitoring priority area	Probability (%) dissolved oil at ≥10 ppb	Min. arrival time dissolved oil ≥10 ppb (days, hours)	Total contact probability (%) floating oil ≥1g/m²	Min. arrival time floating oil ≥1g/m2 (days, hours)	Total contact probability (%) shoreline accumulation ≥10 g/m²	Min. arrival time shoreline accumulation ≥10 g/m² (days, hours)	Probability (%) of entrained hydrocarbon exposure at ≥10 ppb	Min. arrival time entrained exposure at ≥10 ppb (days, hours)
Subsea pipeline leak of Reindeer condensate near the HDD crossing (Scenario 3)								
Northern Islands Coast	NC	NC	NC	NC	28.33	2 hours	NC	NC
Dampier Archipelago	NC	NC	NC	NC	NC	NC	8.67	2 days, 18 hours
MDO spill resulting from a vessel collision at the WHP (Scenario 4)								
Montebello Islands	0.33	4 days, 12 hours	NC	NC	1	3 days, 23 hours	6	3 days, 3 hours
Muiron Islands	NC	NC	NC	NC	2	10 days, 9 hours	9.67	6 days, 17 hours
Southern Islands Coast	NC	NC	NC	NC	1	10 days, 20 hours	10.67	6 days, 20 hours
Barrow-Montebello Surrounds*	0.33	3 days, 21 hours	NC	NC	NA	NA	11.00	2 days, 19 hours
Glomar Shoals*	0.33	4 days, 4 hours	NC	NC	NA	NA	8.33	3 days, 9 hours
Montebello AMP*	5.33	18 hours	NC	NC	NA	NA	42.67	16 hours
Ningaloo Offshore*	0.33	5 days, 22 hours	NC	NC	NA	NA	13.67	4 days, 6 hours
Penguin Bank*	NC	NC	NC	NC	NA	NA	5.33	6 days, 5 hours
WA State Waters†	0.33	2 days, 16 hours	NC	NC	NA	NA	11.33	1 day, 22 hours
MDO spill resulting from a vessel collision at the CSB (Scenario 5)								
Dampier Archipelago	0.33	3 days, 19 hours	0.67	2 days	1.67	2 days, 8 hours	5.67	1 day, 13 hours
Dampier AMP*	NC	NC	NC	NC	NA	NA	7.67	2 days, 8 hours
Barrow Island	NC	-	NC	NC	4.33	5 days, 13 hours	13.00	4 days, 6 hours
Lowendal Islands	0.67	4 days, 22 hours	NC	NC	6	4 days, 9 hours	21.33	3 days, 10 hours
Madeleine Shoals*	NC	NC	NC	NC	NA	NA	7.67	2 days, 17 hours

Scientific monitoring priority area	Probability (%) dissolved oil at ≥10 ppb	Min. arrival time dissolved oil ≥10 ppb (days, hours)	Total contact probability (%) floating oil ≥1g/m²	Min. arrival time floating oil ≥1g/m2 (days, hours)	Total contact probability (%) shoreline accumulation ≥10 g/m²	Min. arrival time shoreline accumulation ≥10 g/m² (days, hours)	Probability (%) of entrained hydrocarbon exposure at ≥10 ppb	Min. arrival time entrained exposure at ≥10 ppb (days, hours)
Montebello Islands	0.67	3 days, 16 hours	NC	NC	9.33	3 days, 21 hours	19	2 days, 14 hours
Barrow-Montebello Surrounds*	0.67	3 days, 8 hours	NC	NC	NA	NA	20.67	2 days, 9 hours
Montebello AMP*	0.33	19 hours	NC	NC	NA	NA	23.67	15 hours
Ningaloo Offshore*	NC	NC	NC	NC	NA	NA	5.67	4 days, 4 hours
MDO spill resulting from a vessel collision at the HDD Crossing (Scenario 6)								
Cod Bank*	NC	NC	NC	NC	NA	NA	27.67	2 days, 18 hours
Dampier Archipelago	NC	NC	NC	NC	25	2 days, 5 hours	66	1 day, 4 hours
Northern Islands Coast	NC	NC	NC	NC	47.67	2 hours	NC	NC

** Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

† This receptor is the WA State Waters boundary and is not an EVA defined by Santos.

NC: No contact to receptor predicted for specified threshold

NA = Not applicable

Appendix O Forward operations guidance

The IMT operate from Perth within the Santos IMT room. These rooms are equipped and subject to reviews and updates as detailed in the Santos Incident Management Plan – WANATL (7700-650-PLA-0016.20).

For a significant Level 2/3 response requiring coordination of resources to be deployed to the field, Santos will establish a forward operations base (FOB). For a Level 2/3 spill crossing from Commonwealth to State waters (cross-jurisdictional spills) DoT will establish an FOB.

Further information on FOBs is provided in the Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

For the activities associated with this OPEP, Santos will likely establish an FOB at the Santos's Dampier facilities leased from Toll Energy. These facilities are located in Toll Energy's Yard 1 and Yard 2 on Streckfuus Road Dampier; the facilities consist of a conference room and multiple offices that could be used as break-out rooms. The Toll Energy Dampier facilities are already connected to the Santos internet and telephone system. These facilities are also available to the DoT to establish an FOB for State based response. There is also an option to use the Port of Onslow at Beadon Creek, subject to approval from DoT. The Port of Onslow has a suitable dredged berth and tarmacked areas for equipment laydown, and a building suitable for set-up of an FOB.

Additional FOBs may be set up as operational requirements dictate. Refer to Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017) for details on the other potential FOB locations.

Accommodation is available at the Devil Creek Accommodation Camp located adjacent to the DCGP and onshore pipeline. Where possible local facilities will be utilised to accommodate response personnel, however transportable accommodation and messing facilities can be supplied through contract suppliers if required.

Appendix P Oiled wildlife response personnel and equipment

In the event of a spill impacting wildlife, Santos will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) and WAOWRP.

This appendix outlines the current OWR equipment, personnel and services available to Santos through current arrangements.

Overall OWR capability per OWR strategy

The overall OWR capability of Santos is outlined in Table P-1. Santos has access to aircraft that could be used for wildlife reconnaissance within hours of a spill. This would be followed by further access to vessels and Santos personnel trained in OWR that could be mobilised within 24 hours for vessel and wildlife shoreline reconnaissance, demonstrating Santos' ability to mount a swift response that could also be sustained as long as required.

Santos has the capability to set up oiled wildlife field stations within 3–4 days of a spill through access to AMOSC equipment and equipment purchased at the time of a spill. Santos could also arrange the transport of wildlife from the field to a primary care facility.

The indicative personnel required for a high impact-rated response is 93 personnel (as per the WAOWRP) (DBCA, 2022a), however depending on the number and species impacted, may require many more. Santos' current arrangements could support a large scale OWR (requiring >93 personnel) mainly through support staff, such as, non-technical wildlife support roles (management, logistics, planning, human resourcing, transporter, cleaners, trades persons, security etc). These roles could be filled by Santos personnel and labour hire agencies that can provide workers that undergo an induction and basic training. In addition, many of the roles required for an OWR require technical expertise and Santos will need to activate OWR arrangements with AMOSC and OSRL to fulfil roles, as well as make contractor arrangements for accessing skilled wildlife personnel at the time of a spill.

Table P-1: Santos OWR capability per OWR strategy

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
Reconnaissance	Identify opportunities to create synergies with surveys required for monitor and evaluate, and operational and scientific monitoring activities	Rotary Wing Aircraft & flight Crew	Karratha	Wheels up within 1 hour for Emergency Response.
		Drones and pilots	Local WA hire companies	1-2 days
		Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
		Aerial surveillance crew Santos staff AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel available	Perth and Varanus Island (VI) (Santos aerial observers) Australia wide	Santos trained personnel – next day mobilisation to airbase <24 hours
Preventative actions	Mainly effective for bird species Requires relevant WA/NT licence approval	5 x AMOSC Wildlife fauna hazing and exclusion kits 1 x AMOSC Breco buoy	4 x Fremantle, 1 x Geelong 1 x Fremantle	Location dependent
Rescue and field processing	Wildlife handling and first aid should only be done by persons with appropriate skills and experience or under the direction of DBCA	4 x AMOSC Oiled Fauna Kits (basic medical supplies, cleaning/rehab, PPE)	1 x Exmouth, 1 x Broome, 2 x Geelong	Location dependent
		2 x DBCA OWR trailers	1 x Kensington NSW 1 x Karratha WA	Location dependent
		50% of OSRL OWR response packages (Wildlife Search and Rescue kits / Cleaning and Rehab. kits (including field first aid)	5 x Singapore, 2 x Bahrain, 7 x UK, 5 x Fort Lauderdale	Location dependent
Transport	Transport of oiled animals by aeroplane or helicopter may be restricted due to Civil Aviation Safety Authority (CASA) regulations; such transport will depend on the level of oiling remaining on animals. Therefore, consultation with the air transport provider must take	Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
	place before transport to ensure the safest and most efficient means			
Primary care facility	OWR container could be placed on the deck of a suitably sized vessel for field processing in remote locations (benefits associated with temperature regulation and access to water and electricity) An OWR container on a vessel could also be used to aide transport form offshore islands	OWR container/mobile washing facility 2 x AMOSC 4 x AMSA 2 x DoT	AMOSC – 1 x Fremantle, 1 x Geelong AMSA - 1 x Dampier, 1 x Darwin, 1 x Devonport, 1 x Townsville DoT – 1 x Fremantle (AMOSC warehouse), 1 x Sydney	Location dependent
		AMOSC call off contract with DWYERTech NZ – a facilities management group	New Zealand	Availability within 24 hrs of call-off
Personnel	Untrained personnel would receive an induction, on-the-job training and work under the supervision of an experienced supervisor	Santos provides OWR training to staff, and to-date, 16 personnel have received OWR training.	Perth and Varanus Island	<48 hours
		Santos maintains labour hire arrangements for access to untrained personnel		
		1 x AMOSC Oiled Wildlife Advisor	Perth, Western Australia	<48 hours
		62 x trained industry personnel (AMOSC OWR Strike Team members)	-	<48 hours
		AMOSC MOU with Phillip Island National Park (PINP) (best-endeavours availability)	Victoria, Australia	Best-endeavour availability
		AMOSC MOU's – WA organisations	WA	Best-endeavour availability
	Sea Alarm staff act in a technical advisory role and do not engage in hands-on OWR activities but work impartially with all parties (titleholder, local authorities, mobilised experts and local experts, and response groups), aiming to maximise the effectiveness of the wildlife response.	Via OSRL Access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation Access to OWR assessment service from the Global Oiled Wildlife Response Service (GOWRS) consisting of a ready-to-deploy team of 4 specialists in Operations/Planning, Field & Capture, Rehab & Facilities, Vet/Incident-specifics.	Belgium Various locations in northern and southern hemisphere	Sea Alarm: Upon notification able to provide remote advice and option to mobilise a Sea Alarm Technical Advisor on-site during an incident GOWRS: Mobilised on a best endeavours basis

Australian Maritime Safety Authority (AMSA)

AMSA maintains four oiled wildlife response containers/ mobile washing facilities in Dampier, Darwin, Devonport and Townsville. All resources under the National Plan (including the four OWR containers) are available to Santos through formal request to AMSA under the arrangements of the National Plan. The containers also include some limited PPE and fresh and wastewater pools.

Western Australia Department of Transport (DoT)

The WA DoT maintains 2 x OWR containers/ mobile washing facilities (WA Fremantle – AMOSC warehouse, and NSW Sydney) which are available through the SHP-MEE and the AMSA National Plan on request.

Australian Marine Oil Spill Centre (AMOSC)

Santos is a participating Member of AMOSC and as such has access to AMOSC's Level 2/3 oiled wildlife equipment and personnel as outlined in the AMOSPlan and the AMOSC OWR Stateboard.

Equipment

Table P-2 provides a summary of the oiled wildlife response equipment maintained by AMOSC.

Table P-2: AMOSC wildlife equipment

Location	Oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	Fauna hazing and exclusion equipment	Oiled wildlife washdown container (mobile washing facility)
Fremantle	-	4 x fauna hazing & exclusion kit 1 x Breco bird hazing buoy	1 x Oiled Wildlife Washdown Container
Exmouth	1 x Oiled fauna kit	-	-
Broome	1 x Oiled fauna kit	-	-
Geelong	2 x Oiled fauna kit	1 x fauna hazing & exclusion kit	1 x Oiled Wildlife Washdown Container
Total	**4 x Oiled fauna kit**	**5 x fauna hazing & exclusion kits** **1 x Breco bird hazing buoy**	**2 x Oiled Wildlife Washdown Containers**

Personnel

AMOSC currently has the following arrangements in place for OWR personnel:

- 1 x AMOSC OWR Officer available to act as an Industry Oiled Wildlife Advisor (OWA)
- 62 x trained industry personnel (AMOSC OWR Strike Team members)
  - Volunteer OWR trained industry personnel
- Wildlife Care Groups:
  - 35 introductory trained personnel
  - 24 completed management course
  - 16 completed Responder course
- AMOSC call off contract with DWYERtech Response NZ
  - A facilities management group with availability within 24 hours of call off – 2 x personnel
- AMOSC has the following MoU's in place:
- Phillip Island National Park (PINP), (VIC) (best-endeavours availability)
  - Approx. 50 PINP staff – collection/facility ops/rehabilitation
  - Approx. 45 volunteers – collection/facility ops/rehabilitation

  - Approx. 20 staff – animal feeding
  - 6 x PINP staff – wildlife emergency response including cetacean stranding/entanglement
  - 17 x PINP staff – wildlife team leaders
  - 5 x PINP staff – IMT Training
- Blue Planet Marine (WA)
  - 10-20 Personnel (best endeavours to respond)
- WA Seabird Rescue
  - No permanent staff, ~30 volunteers
- WA Native Animal Rescue
  - 5 staff, ~80 volunteers
  - Wangara – Avifauna and mammals
  - Broome – Marine turtles
- WA Wildlife
  - 10 staff, ~80 volunteers
- Darling Range Wildlife (WA)
  - 5 staff, ~50 volunteers
- Mandurah Wildlife (WA)
  - 5 staff, ~30 volunteers

Oil Spill Response Limited (OSRL)

Through the associate membership, Santos has access to the following OWR equipment and personnel services from OSRL.

Equipment

OSRL maintains a Level 3 wildlife equipment stockpile. This equipment is stored across the OSRL base locations and is designed to support the first 48 hours of the response and to ensure availability of critical equipment items that may be difficult to source locally (Note: this equipment does not provide everything that will be required to successfully operate a primary care facility and is focussed primarily on bird casualties (n=100)). Equipment is sorted according to search and rescue (including field first aid), medical, and cleaning and rehabilitation (Table P-3).

Table P-3: OSRL wildlife equipment (as per OSRL Equipment Stockpile Status Report, November 2024)

OWR Response Package	UK	Singapore	Bahrain	Fort Lauderdale
Wildlife Search and Rescue BHR	-	-	-	-
Wildlife Cleaning and Rehabilitation Part 1	2	1	1	1
Wildlife Cleaning and Rehabilitation Part 2	2	1	-	1
Wildlife Cleaning and Rehab. Medical	1	1	-	1
Wildlife Search and Capture	1	1	1	1
Wildlife Search and Capture Medical	1	1	-	1

Personnel

Through the OSRL SLA, Santos has access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation, a small non-governmental organisation based in Brussels, Belgium that works to improve global preparedness and response for oiled wildlife incidents. Two technical Advisors are available, with one providing remote support and the other available to be mobilised for on-site support, either in-field or at the Command Post (typically working with the Wildlife Branch Director or the Planning and Operations sections as appropriate).. Sea Alarm staff will act in a technical advisory role at the incident management level and will work impartially with all

parties (titleholder, local authorities, mobilised experts and local experts, and response groups), with the aim of maximising the effectiveness of the wildlife response.

Through OSRL's ongoing funding of the GOWRS Project, a wildlife assessment team of 4 wildlife experts can be mobilised in-field for up to 4 days in addition to the Sea Alarm resources noted above. The GOWRS Oiled Wildlife Assessment Service is a ready-to-deploy 4-person team delivered by a network of 10 leading wildlife response organisations. The four-person team will initially deploy for 4 days to provide an on-the-ground technical assessment of wildlife response needs and the professional capabilities of local responders. The team will inform the client of the feasibility of a full-scale professional response and the details of the GOWRS expertise that is available to deliver to the scale of such a response. There is also access to additional oiled wildlife resources on a 'reasonable endeavours' only basis through the GOWRS partners.

In addition, through the SLA, Santos has the option to access OSRL's internal staff with OWR expertise (1 x UK) as part of the 18 personnel commitment for any single incident.

Appendix Q Santos Incident Response Telephone Directory

Santos incident response telephone directory (7700-650-PLA-0016.20), Rev 72, 21st January 2025.

Incident Response Telephone Directory

PROJECT / FACILITY	Corporate
REVIEW INTERVAL (MONTHS)	6 Months
SAFETY CRITICAL DOCUMENT	YES

Rev	**Owner**	**Reviewer/s** *Managerial/Technical/Site*	**Approver**
	Senior Crisis, Security & ER Adviser	**Senior Crisis, Security & ER Adviser**	**HSS Manager, WANATL**
72	Michelle Morrison	Michelle Morrison	Adam Kestel

Rev	Rev Date	Author/Edit	Amendment
55	1/10/2021		General update of whole document by various relevant departments
56	22/11/2021		Updated TRG details and new drilling details & Oceaneering 24hr no.
57	18/1/2022		Updated TL office & DLNG details
58	24/3/2022		Updated AFMA & DPIRD. Removed IMT team desk phones
59	28/4/2022		Updated DMIRS numbers after incident & general update/check of whole document
60	29/6/2022		Adding additional Home Affairs/Border Watch Details & MS-1 details
61	26/8/2022		Amending Veolia details, added Advisian & SDS
62	25/10/2022		Updated Energy Policy contacts, Ningaloo vessel update and all sections by various personnel. Also tested those sections not verified by others eg. government departments
63	03/03/2023		Updated VP contacts, took out NTP contacts, added Senversa – Jason Clay details
64			Updated Exmouth heliport details for NV, took out Astron & add RPS for SMP & added other operator HSE & Emergency contacts. Added ISOS
65	18/5/2023		6mthly review by sites/section holder to verify numbers. Tested sections not verified by other personnel.
66	20/6/2023		Added additional emails for Flag State Panama. Santos Primary Dr. Tiwi resources stakeholders added & DFAT GWO
67	26/6/2023		Update BU satellite phones. Offshore VP details, DC satellite, Far Seeker for BU
68	11/7/2023		Updated Devil Creek Numbers; Added DBCA Kimberley regional office; Added Tiwi Island's Munupi clan members' contact details; Added DFAT contacts for Timor-Leste or Indonesian Specific Matters. 6 mth review.
69			Updated Waste Management providers' NWA & Veolia Darwin's contact details. Changed ANPM to ANP.
70	20/11/2023		Document updated to new branding guidelines. Contents reviewed for NT notifications.6 mth review. Updated DMIRS to DEMIRS, 6mthly check by relevant parties & phone check of numbers not checked ie regulators etc.
71	25/6/2024 – finished 20/9/2024		6mthly review.
72	21/1/2025		Panama Flag details. Weststar added. BW Opal added. Commercial details amended. 6mthly update. Updated RPS Oil spill response modelling email. Removed RPS and Advisian OSM contact details.Added note to OSRL's contact that their services include OSM services. Update of North-West Alliance contact details for personnel change. Updated Veolia contact details for personnel changes

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Appendix 1 Satellite Phone Dialling Pre-Fixes List 38

1. Revision Procedure

This document will be revised and reissued six-monthly.

This is a controlled document and as such will be maintained through the document control system.

All numbers are stated as if calling from Australia.

If calling from outside of Australia substitute “0011” for your local international calling code.

If making international call to Australia dial your local outgoing country code followed by 61

Please see Appendix 1 for Satellite Phone Dialling Prefix list

2. Santos WANATL Incident Control Group

2.1. Incident Management Team

Role	Position/Location	Phone Number
	IMT Duty Manager	08 6324 0381
IS resource – when automated message answers, press “1” key after each question for an emergency (Alternatively submit request through self-service portal and mark urgent)		Within Santos 7777 Within Australia (08) 8116 7777 Outside Australia +61 8 8116 7777
Santos IS Security Manager	Andrew Speer	0418 831 428
Operational Technology Team Leader	Paul Goulding	0419 045 562
Lead Oil Spill Risk & Planning Coordinator	Anpa Sockalingam	0450 783 410
Principal Security Adviser	Greg Metzger	0433 860 380
Crisis & Emergency Response Adviser	Michelle Morrison Satellite Phone (Office)	0418 905 776 0147 144 323
VP notification	Regardless of the asset, the IMT Duty Manager is to notify the rostered Perth IMT to CMTdelegate: Link to: Perth IMT to CMT delegate roster Vice President (VP) Upstream Gas & Liquids - Marcia Evans 0407 479 744 GM WA Production - John Sarto 0427 414 537 General Manager Drilling & Completions & Decomissioning Jason Young - 0411 402 455 Barossa Project Director Gareth Bamford - 0439 255 492	
IMT activation number	Connect Call centre (Only IMT Duty Manager to call)	08 6324 0381

2.2. Santos Offshore & Drill Rig Facilities

Location / Asset	Position/Location	Phone Number
Varanus	VI Emergency Commander	08 6218 7640/08 6218 7601
	Radio Room (vacant but phones still there)	08 6218 7984 08 6218 7696
	Radio Room - Satellite Phone	0147 160 415
	Control Room	08 6218 7637 08 6218 7600
	Control Room – Satellite Phone	00 11 870 776 624 068
	Offshore Installation Manager	08 6218 7601
	Offshore Installation Manager – A/H	08 6218 7606
Devil Creek	Control Room (Perth Operations Centre with backup at DC)	08 6218 7700
	Control Room on site – Fixed Satellite	+ 870 776 624 043
	Portable ER Room (only turned on during total comms loss)	0147 183 763 0147 144 779
	Incident Communications Operator	08 6218 7734
	Village Manager	08 6218 7683
	Village/Dining Refuge – Satellite Phone	+870 776 624 060
	Reindeer – MCC	08 6218 7724
	Reindeer – Satellite Phone	0147 166 441
	Person In Charge	08 6218 7701
	Person In Charge – A/H	08 6218 7700 (CCR number and ask for PIC)
	Mob – Tony Morrison	0412 463 669
	Mob – Rob Wasley	0427 999 328
	CS1 Portable - satellite phone	0147 144 779
Ningaloo Vision	Process Control Room	08 6218 7900
	OIM office	08 6218 7901
	Heli Admin	08 6218 7920
	Medic	08 6218 7907
	Bridge	08 6218 7911
	Fleet Broadband - Process Control Room Phone, Cargo Control Room, Telecoms Room, Bridge, OIM Quarters	+870 773 301 007
	ITRA - Alternate Command Muster	08 6218 7960
	Satellite Phone – Marine Supervisor (Outside Use Only)	0147 158 809
	Satellite Phone – OIM (Outside Use Only)	0147 164 470
	OIM – A/H	08 6218 7930

Location / Asset	Position/Location	Phone Number
	Mob – Wes Renton	0414723833
	Mob – Steve Baird	0407 132 220
Vessel – Go Provider	Go Offshore Ship Ship Mobile: VOIP:	+61 499 020 073 +61 863777197 08 6146 6201 Bridge.provider@gooffshore.com.au
Timor Leste Office	Country Manager	José Lobato Gonçalves +670 7723 0856 + 618 6363 4001
	Timor Leste Engagement Coordinator	Reinalda Pires +670 7739 3553 + 618 6363 4000
	Business Services Supervisor	Elisabeth Gomes +670 7735 7543 + 618 6363 4005
	Timor Leste Engineering Supervisor	Robin Araujo +670 77393551 + 618 6363 4041
Timor Leste Authorities Contact with ANP should be made via Reza Dashti - 0423 630 954	Autoridade Nacional do Petróleo (ANP)	+670 7309 9995 +670 7309 9996
	ANP HSE Directorate Constantino Afonso Pinto Manager – Health, Safety Inspection & Investigation Paulo Guterres Manager – Environmental Inspection & Investigation Jose Sarmento	” +670 730 99997+670 777 45577Prefers call or text via “WhatsApp” +670 332 4098 (Ext 5016) +670 7347 5848 Prefers call or text via “WhatsApp” +670 332 4098 (Ext 5012) +670 76330336 Prefers call or text via “WhatsApp”
	ANP Security Phone – 24/7	+ Currently waiting for new number that works Constantino Pinto +670 730 99997 +670 777 45577 Tel: +670 332 4098 (Ext. 5027) Mobile : +670 7727 0646 & 73510597 E-mail: constantino.pinto@anp.tl
	Timor-Leste National Police (PNTL) National Operation Centre	Off) (+670) 331 1380 (Off) (+670) 331 0080

Location / Asset	Position/Location	Phone Number
		(Mob) (+670) 7798 0844
	Australian Embassy in Timor	+670 332 2111
	Department of Foreign Affairs & Trade (DFAT) 24-hr Consular	+61 2 6261 3305
MoH	TL Ministry of Health	Dr. Lizete Vong+670 7747 9443 Prefers call or text via “WhatsApp”
Stamford Clinic	Stamford Medical Clinic	Mr. Derek Chua +670 7743 4980 +670 3310141 Portia Roa (COO) +670 7786 5688
Timor Leste Security	Deputy Operations of Air Disaster – Mr Mariano Ana Lopes	+ 670 7732 8714
	Unidade Policia Maritima (Maritime Police Unit) – Mr Cancio de Jesus – National Operations Commander	+670 7595 9303
	Deputy Operations of Maritime Disaster (Civil Protection Authority) Mr. Cosme Camilo da Costa (Arrange Search & Rescue)	(Mob) +670 7796 5177 +670 78141712 +670 77312998 +670 3311044
	Australian Maritime Border Operations – Duty Officer	02 6246 1313
	Australian Border Force – Duty Officer	1800 009 623 (24 hrs) +61 2 6246 1325
	Australian Border Protection Command National Surveillance Centre	1800 041 800
	Australian National Security Hotline	1800 123 401
	International Maritime Bureau Maritime Hotline	+603 2031 0014
	Department of Foreign Affairs and Trade (DFAT) 24-hr Consular Helpline	+61 2 6261 3305
	Defence Assistance to the Civil Community Initiative HQ ACT/NSW	1300 552 900
	Dep. Of Infrastructure, Transport, Regional Development and Communication	1300 307 288 1300 333 362
Bayu-Undan CPP	CPP CCR Operator (Emergency only)	08 6363 1140
	CPP CCR Emergency Commander - MOME Board	08 6363 1296
	CPP CCR number (Business use)	08 6363 1141
	Secondary Emergency Control Room	08 6363 1180
	CPP OIM	08 6363 1151
	CPP Ops Super	08 6363 1149
	CPP Medic Room	0011 870 773 205 655 (currently out of service)) (satellite hardwire)
	CUQ Heli Admin Area	08 6363 1145

Location / Asset	Position/Location	Phone Number
	CUQ Medic	08 6363 1144
	TER, OIM, CCR	0011 870 773 205 655 (satellite phone)
	CUQ Handheld Iridium Phone	0011 881 621 465 711 (Satellite Hand held) (Facility abandonment phone)
	Offshore HSE	08 6363 1220
Vessel – Britoil Dragon – Go Offshore	On Vessel Emergency Contacts On Shore Megan Perkins Crewing Manager/MLC Rep Lee Seubert Operation Manager DPA/CSO	VSAT +6531591356 IRIDIUM +881677126445 MOB +61 499 040 032 MOB +61 488 020 052 MOB +61 458 020 013
Vessel – Rawabi Topaz– Go Offshore	On Shore Megan Perkins Crewing Manager/MLC Rep Lee Seubert Operation Manager DPA/CSO	Bridge VSAT: 61 8 6285 9870 Ships Mobile +61 499 020 510 Email: Bridge.topaz@gooffshore.com.au MOB +61 488 020 052 MOB +61 458 020 013
Bayu-Undan FSO	FSO CCR Operator	08 6363 1001 (24hrs) 08 6363 1011 (24hrs) 08 6363 1100 (Cordless Phone)
	FSO – Emergency Commander (OIM)	08 6363 1001 (24hrs) 08 6363 1011 (24hrs) 08 6363 1100 (Cordless Phone)
	FSO Satellite handset in CCR, OIM office, Medical Centre & TER	0011 870 773 204 862
	FSO Handheld Iridium Phone	0011 881 621 465 711 Only used during Facility Abandonment Hand Held Satellite phone
	FSO Heli Admin (Field Medic)	

Location / Asset	Position/Location	Phone Number
		08 6363 1006
	FSO OIM Office	08 6363 1003
	FSO Ops Super	08 6363 1000
	FSO Medic Room	08 6363 1005 Satellite Hardwire 0011 870 773 204 862
	Dili based Aviation Coordinator	+670 777 25096 +670 778 94175
DLNG Facility	Emergency – CCR emergency phone	08 8919 1580
	Emergency Commander	08 8919 5162
	Control Room Supervisor	08 8919 1579
	Communications Officer	08 8919 5163
	ERT Equipment Room	08 8919 5118
	DLNG Medic	08 8919 1589 0498 317 975
	DLNG Security Gatehouse	08 8919 1600
	Loss of External Communications:	Satellite CCR: 0011 870 772 396 080 Satellite Process Supervisor: 0011 881 621 461 586
	INPEX Security	08 8983 8025
	INPEX CCR Panel Operations Team Leader LNG Operations Team Leader CCPP/UTES	08 8983 806008 89 83 8036 08 89 83 8066
	INPEX Security & EMAdvisor	0459 415 099
BW Opal	EMERGENCY RESPONSE TABLE	08 9224 5490 then dial 2222
	EMERGENCY COMMANDER	08 9224 5490 then dial 2007
	CENTRAL CONTROL ROOM	61 8 9224 5490
	OIM OFFICE	61 8 9224 5491
	OTL OFFICE	61 8 9224 5492
	OPERATION SUPERINTENDENT OFFICE	61 8 9224 5493
	HSSE SUPERINTENDENT OFFICE	61 8 9224 5497
	CONSULTATION ROOM - MEDIC	61 8 9224 5498
	MATERIAL COORDINATOR	61 8 9224 5499
	BWO Duty Manager	0488 477 196
MS-1 – Onshore - Santos	Jason Young	08 6218 4980 0411 402 455

Location / Asset	Position/Location	Phone Number
	Sam McLennan	04390439 415 313 Sam.McLennan@contractor.santos.com
	Mark Gilmore	+61881165356 Mark.Gilmour@santos.com
	Mark Salera	0408 317 695 mark.salera@santos.com
	Mark Murray	0406 040667 996 Mark.Murray@contractor.santos.com
	Drilling Supervisor - Day	08 6218 4642 Travis Marriot /Craig Lucas offshore.ds.ms1@santos.com
	Drilling Supervisor - Night	08 6218 4643 Christopher (Chris) Beck offshore.nds.ms1@santos.com
	Materials Logistics Coordinator	08 6218 4644 Luke Byres/Gavin Poschkens
MS-1- Onshore – Valaris	Alistair McDonald Rig Manager	08 6146 6366 0438 754 969 Alistair.mcdonald@valaris.com
	Christian Ward Operations Support Engineer	+61 0475 146 631 Christian.Ward@valaris.com
	Luke Buscada QHSE Manager	08 6146 6358 0448 941 812 Luke.Buscada@valaris.com
MS-1 – Offshore – Valaris	MS-1 Call Sign D5P17 / IMO# 8770314	
	Radio Room (24hr coverage)	08 6313 6856 08 6218 4649 +8707 7320 4374 sat Rms1Radio@valaris.com
	James Savoy Malcolm O'Driscoll MS-1 OIM	08 6313 6855 +8707 7645 7106 Sat Rms1OIM@valaris.com
	Hospital (medic cabin)	08 6313 6854 Rms1Medic@valaris.com
MS-1 – Barossa – Onshore Materials & Logistics – Darwin Supply Base	Win Forsman	0421 762 536
MS-1 – Marine Superintendent	Rahul Pandit	+61 8 6218 7412 +61 417 952 098 Pandit, Rahul (Rahul) <Rahul.Pandit@santos.com>
MS-1 Vessels – Solstad Offshore ASA	Joel Mullins Operations Director APAC	+61 8 9421 9315 +61 40095 8778 Joel Mullins <joel.mullins@solstad.com>

Location / Asset	Position/Location	Phone Number
Perth, Australia		
Vessel – Normand Ranger	VSAT: +47 52856055 | Mobile: +61 0428565871 | Sat: +881 677102436 E-mail: ranger.bridge@solstad.com	
MS-1 Vessels – Tidewater Perth, Australia Adeline Yip Country Manager, Australia and New Zealand Razia Khan Regional QHSE Manager, Asia Pacific	Adeline Yip <adeline.yip@tdw.com> Razia Khan Razia.Khan@tdw.com (+65) 89384066	
Vessel –Seeker Tide Tidewater	Iridium **+88 1677108295**	
	V-SAT **+47 2278 5325 / +47 2278 5326**	
	GSM: **+61 (0)457 405 363**	
	E-mail: Seeker Tide <seekertide@tdw.com>	
Vessel – Britoil Dragon	VSAT: +65 31591356 IRIDIUM: +881677126445 MOB: +61 499 040 032 bridge.dragon@gooffshore.com.au	
Go Offshore Perth WA	Lee Seubert General Manager Operations (DPA / CSO) Phone: +61 8 9474 3600 Mobile: +61 4 58 020 013 Email: lee.seubert@gooffshore.com.au	
Vessel – Go Spica Go Offshore	FBB +870 773 802 676	
	V-SAT +61 8 6555 7093	
	Master Mobile +61 (0) 488 020 105	
	E-mail: bridge.spica@gooffshore.com.au	
Offshore Services Australasia Pty Ltd	Duty Operations Officer (including Night Operations) 24 hr primary activation. Tel: 0418 654 360	

Location / Asset	Position/Location	Phone Number
Darwin Base	Email: darwin.base@offshoreservicesaustralasia.com	
	Base Manager Tel: 0475 758 152 (24hr secondary activation) Email: darwin.basemanager@offshoreservicesaustralasia.com OSA.DWNBM@chcheli.com	
	Senior Base Pilot Email: darwin.seniorbasepilot@offshoreservicesaustralasia.com	
	Senior Base Engineer Email: darwin.seniorbaseengineer@offshoreservicesaustralasia.com	
Offshore Services Australasia Pty Ltd Adelaide	Operations Cell - Offshore (On-Call) Mobile: +61 447 428 718 Email: offshoreoperations@offshoreservicesaustralasia.com	
Apex	Please refer to Apex Contact list on EHS & ER tile	https://santos.sharepoint.com/sites/Intranet/EHS-Emergency/Pages/Emergency%20Response%20Western%20Australia.aspx
Barossa HSS	Saul Oswald HSS Lead 0437 786 362	
Barossa (Singapore Office)	Tony Quinn FPSO Project Manager +65 8671 0993 Geoff Stacey Project (Topside) HSE Advisor 9349 3653	
Barossa (GEP / DPD)	Ben Haslam Barossa GEP Package Manager 0403 512 339	
Barossa (SURF)	Keith Soutar SURF Delivery Manager 0447 959 236	
Allseas 'Audacia' vessel	Bridge Primary (+31) 1071 30834 Master (+31) 1071 30831 Master Secondary (+87) 077 620 5975	

Location / Asset	Position/Location	Phone Number
Allseas 'Fortitude' vessel	Bridge Primary +31 10 669 0464 Catering Office (+31) 106 690 462 Master +31 10 669 0461	
Subsea7 'Pegasus' Vessel	Bridge Tel: +44 1224 292484 Vessel Master Tel: +44 1224 292 481 Mob: +44 7554 663 491	

3. Forward Operating Bases

Location	Position/Location	Contact Details
Toll Dampier Supply Base Yard 4	Dampier Supply Base Supervisor	0457 631 010 Offshore.dampier.logisticsproduction@santos.com
SES Emergency Centre	Compliance and Emergency Services Coordinator (CESC) (Shire of Exmouth)	0427 491 399 (08) 9949 1699 cesc@exmouth.wa.gov.au
	DFES Officer – responsible for facility - Paul Leiper	0419 937 834 (08) 9159 1400 paul.leiper@dfes.wa.gov.au
	Exmouth SES Unit Manager – Carl Atkin	0438 343 299 Manager@exmouthses.org.au
Harold E. Holt Naval Base Building 142	Naval Base Manager	(08) 9949 3321 0428 936 507 russell.levien@defence.gov.au
	Naval Base Support Services Project Manager	(08) 9949 3326 0417 279 496 gary.northrop@defence.gov.au
Exmouth VMR Building	Exmouth VMR Representative David Skene	(08) 9949 2426 0418 910 027 David.Skene@transport.wa.gov.au

4. Well Control

Company	Position/Location	Notification Details	Mobile	After Hours
Wild Well Control USA Wild Well Control UK	Houston TX	+1 281 784 4700 (primary) +44 1224 215 380 (secondary)		
Oceaneering		Contact 1: Rahman Khandker Project Manager Offshore Projects Group Direct: +61 8 6499 0036 | Mobile: +61 417799938 rrahman@oceaneering.com Contact 2: Jason Hughes Director APAC Offshore Projects Group Direct: +64 8 6499 0080 | Mobile: +61 (0)436 639 355 | Email: jhughes@oceaneering.com		

5. Government Agencies

Department	Position/Location	Notification Details	Mobile	After Hours
Bureau of Meteorology (BOM)	Tropical Cyclone Operations Desk	08 9263 2205		08 9263 2205
	Forecasts Desk	08 9322 4817		08 9322 4817
Pilbara Port Authority	Switchboard	1300 100 772		08 9159 6556 0428 888 800 (24hr Emergency) Ashburton VTS Call sign: Ashburton VTS VHF Channel 14 and VHF Channel 16
	Harbour Master Ashburton - Anurodh Prasad Harbour Master Dampier – Mike Minogue	08 9159 6508	0400 468 724 0427 485 708	
	Deputy Harbour Master Vasyl Stiazhkin or Murali Krishna		 0418 521 659 0437 296 583	
	The Emergency Towe	08 9159 6556 0428 888 800		
Darwin Port Authority	Darwin	+61 (0) 401 110 320 Or +61 (0) 8 89190 816		
Port Melville – Tiwi Islands	Harbour Master – David McDonald	0409 328 337		
Department of Energy, Mines, Industry Regulation & Safety (DEMIRS) was Department of Mines, Industry Regulation and Safety (DMIRS)	Environment Duty Officer (Reportable incidents)	0419 960 621 or 9222 3727 Petroleum.environment@dmirs.wa.gov.au	0419 960 621	These numbers are now only manned between 9am-5pm Mon-Fri– 0419 960 621 may be diverted over weekends Outside office hours use email – petroleum.environment@dmirs.wa.gov.au
	Reporting an accident or incident (safety) Press 1 to report an incident	1800 723 364		
	Energy Safety	Sarah Roberts (media – electrical and Gas , building issues) 08 6552 9453 0466 409 828 (A/H) Mining & Resource (media – related to sites)		Incident reporting line 1800 678 198

Department	Position/Location	Notification Details	Mobile	After Hours
		08 9222 6102 media@dmirs.wa.gov.au		
	Worksafe WA	1300 307 877 (Report a Incident press 2) WorkSafe (media) Caroline De-Vaney 0408 927 563 Worksafe (media) Mark Richardson (Mines Media) 08 92222 6102		
	Resource Safety Division and Dangerous Goods	08 6251 2300 DGS&CR Branch – queries re how to complete reporting DGSB@DMIRS.wa.gov.au		Active Incidents 0417 091 662 – on call 0417 933 794 – incident officer
	Well Compliance Duty Officer (Connects to Petroleum Environment Team & Compliance Branch)	0427 479 615	0427 479 615	Only Mon-Fri, 9am-5pm
	Switchboard	08 9222 3333		
Department of Water & Environment Regulation (DWER)	1300 784 782 24 hour pollution watch hotline pollutionwatch@dwer.wa.gov.au			
Department of Climate Change, Energy, the Environment & Water (used to be environment in Department of Agriculture, Water & Environment)	Switchboard – Environment, Water, Parks and Heritage Breaches of EPBC Act (Triage & Wildlife)	1800 920 528 or 1800 110 395. environment.compliance@dcceew.gov.au epbc.permits@environment.gov.au epbc.referrals@dcceew.gov.au	9:00 am to 5:00 pm (AEST) Monday to Friday, except public holidays	
Department of Industry, Science, & Resources (used to be energy in Department of Industry Science, Energy & Resources)		02 6213 6000		
Department of Biodiversity Conservation and Attractions (DBCA)	State duty officer	08 9219 9837 wildlife.protection@dbca.wa.gov.au		08 9219 9837

Department	Position/Location	Notification Details	Mobile	After Hours
	Perth Office	08 9219 9000 - Fire Management Press 1 Sick Wild Life Press 2 Wild Life Permit Press 3 Camping Permit Press 4 Speak to Someone Press 0		
	Pilbara (Karratha) Office Switchboard	08 9182 2000		
	Exmouth District	08 9947 8000		
	Kimberley regional office Native Animals Rescue - Native Animals	08 9195 5500 0407 773 258		
	Nature Protection Branch Manager	08 9219 9840		08 9219 9840
	WILDCARE	08 9474 9055		08 9474 9055
Department of Premier and Cabinet (DPC) – Western Australia		08 6552 5000 (Main)		
Department of Transport (DOT)	MEER Duty Officer – Oil Pollution 24 Hr	08 9480 9924 24hr service (phone this number first) Marine.pollution@transport.wa.gov.au		
	Exmouth Office	(08) 9216 8219 After Hours - 0447 856 774		
Department of Fire & Emergency Services (DFES)	Emergency	000 – fire and life threatening emergencies 132 500 – SES emergency assistance 13 3337 – Emergency Information		
Energy Policy WA (part of DEMIRS) (formerly known as Public Utilities Office)	General EMT 24hr on call Paul Hynch Paul Power Georgina Stamp	08 6551 4600 08 6551 4652 0409 159 835 paul.hynch@dmirs.wa.gov.au paul.power2@dmirs.wa.gov.au georgina.stamp@dmirs.wa.gov.au		08 6551 4652 (24 hr EMT) epwa-emergencymanagement@demirs.wa.gov.au
Department of Primary Industries and Regional Development (DPIRD)	Primary Contact – Mark Pagano Oil spills etc	Mark.Pagano@dpird.wa.gov.au cc in all correspondence via email: environment@dpird.wa.gov.au	0418 779 053	First contact: 0418 779 053
Director of National Parks	Marine Parks Compliance Duty Officer	0419 293 465 marine.compliance@environment.gov.au		0419 293 465
AMSA (Rescue Coordination Centre, RCC) Note from ME:		1800 641 792 (Maritime) 1800 815 257		1800 641 792 (Maritime) 1800 815 257 (Aviation)

Department	Position/Location	Notification Details	Mobile	After Hours
MOB search and rescue (SAR) triggered through AusSar and AMSA available 24/7. 1. Daytime only Helicopter SAR (LIMSAR) response provided by OSA AW139 Helicopter out of Karratha. 2. Activation can be either through OSA Operations directly, or AMSA. My recommendation is that SAR tasking is activated directly to AMSA, with direction provided to them during activation to include our contracted LIMSAR services (OSA) in the formal tasking. Concurrent activation directly to OSA in Karratha will expedite response. Activation protocols are something worth clarifying to remove any potential confusion at time of activation.		(Aviation) rccaus@amsa.gov.au		
CoastWatch (BorderWatch) (Use this number for suspected illegal entries into Australia, suspicious cargo)		1800 06 1800		1800 061 800
Australian Fisheries Management Authority (AFMA)	6am – 12 midnight with ability to leave message. After that it will be transferred to Duty Officer on call b/t Midnight and 6am	02 6275 5818 dutyofficer@afma.gov.au		0419 205 329 (Canberra) Duty Officer 0428 196 114 (Darwin) Duty Officer
Western Australian Fishing Industry Council (WAFIC) and WA commercial fisheries	General WAFIC Enquiries	General WAFIC Enquiries +61 08 9432 7777 oilandgas@wafic.org.au		
Department of Foreign Affairs & Trade	Director of Indonesia Economic and Trade Section 24-hr Consular Helpline	02 6261 1111 (Main)		1300 555 135 Consular Emergency Helpline Or +61 2 6261 3305
National Offshore Petroleum Titles Administrator (NOPTA)	Switchboard	08 6424 5300		
NOPSEMA	Incident Notification	1300 674 472		1300 674 472

Department	Position/Location	Notification Details	Mobile	After Hours
		submissions@nopsema.gov.au		
Comcare (Australian Number)		1300 366 979		
WA State Coroner (Note: contact Police first – if further guidance required use these numbers)	Coronial Investigation Squad (CIS) Office of State Coroner (OSC)	08 9267 5700 08 9425 2900 (business hours)		
NORTHERN TERRITORY NUMBERS				
NT Department of Health		(08) 8999 2400		
NT Government Switchboard (NT DEPWS)		08 8999 5511		
NT Pollution Response Hotline		https://ntepa.nt.gov.au/make-a-report 1800 064 567		
NT EPA		08 8924 4218 1800 064 567 – pollution hotline Will put you through to air quality specialist pollution@nt.gov.au waste@nt.gov.au		
Environmental Operations Waste Management and Pollution Control		Ph: 08 8924 4218 waste@nt.gov.au		
NT Dept. of Industry, Tourism & Trade – Fisheries (formerly known as NT Dept. of Primary Industry & Fisheries)		Ph: 08 8999 2144 fisheries@nt.gov.au Water Police: 08 8947 0391		
NT Dept. of Industry, Tourism & Trade		08 8999 2006		
NT Dept. of Infrastructure, Planning & Logistics (formerly known as NT Dept. of Transport (NT DoT))	Executive director of DIPL	Ph: 08 8924 7598		Going to call back with 24hr no.
Parks and Wildlife Commission of NT		(08) 8999 4555 08 8995 5008 0401 115 702 wildlife.management@nt.gov.au		0401 115 702
Department of Fisheries		08 8999 2006 08 8999 2144		
AFMA (Darwin)		0428 196 114		
NT Government (switchboard who can put you through to rest of government)		08 8999 5511.		

Department	Position/Location	Notification Details	Mobile	After Hours
Department of Infrastructure, Planning & Logistics Formerly known as Department of Lands, Planning & The Environment (NT)	Harbour Master (regional) Deputy Harbour Master (marine safety branch)	08 8999 3867 0428 181 480 Anil.Chadha@NT.gov.au 08 8924 7101 marinesafety@nt.gov.au		
Darwin Port – DP		1300 327 946		
Fort Hill Wharf - 24 Hours		08 8919 0817		
DP Harbour Control East Arm Operations – 24 Hours		08 8919 0821		
On-Duty Maritime Security		08 8947 4205 0401 110 320		
Air Quality		08 8924 4057		
APA Group	NT Gas emergency	1800 019 112 Or 1300 087 621		1800 019 112 Or 1300 087 621
NT WORKSAFE	DG's, Chemical & Workplace Accidents 24hrs (Switchboard)	1800 019 115 ntworksafe@nt.gov.au		1800 019 115
NT Power & Water	Emergency & Fault line	1800 245 090		"000" if unavailable on 1800
NT Road report – Cyclone info		1300 659 211		
Office of the Territory Coroner		08 8999 7770 nt.coroner@nt.gov.au		
INTERNATIONAL NUMBERS				
Flag State Panama Segumar Singapore	Flag State Panama Segumar Singapore	+65 6221 8677 ext 204		
Flag State Panama (Ningaloo Vision only)	Eng. Gonzalo Cortez Chief/Marine Invesigator Maritime Affairs Investigation Department e-mail: gcortez@amp.gob.pa Phone: +507 501-5039 Eng. Andres Alvarado Deputy Chief / Marine Investigator Maritime Affairs Investigation Department e-mail: aalvarado@amp.gob.pa Phone: +507 501-5087	0011 507 501 5039 24 hr 0011 507 501 5087		

6. Oil Spill including Stakeholders to Contact

Company	Position/Location	Phone	Mobile	After Hours
AMOSC (amosc@amosc.com.au) Provision of oil spill response equipment and personnel	Duty Officer 24hrs	0438 379 328	0438 379 328	0438 379 328
SFRT – Called out under AMOSC Call out procedure for the SFRT: STO calls and sends official request to AMOSC for the use of the SFRT kit Contract note to be signed off by STO and AMOSC AMOSC will notify Oceaneering to issue the SFRT kit to STO STO to issue PO to Oceaneering				The SFRT is a toolbox of specialised equipment that has the ability to remove (light) debris near the wellhead and BOP, apply dispersants and enable direct BOP intervention. It aids in the preparation of the area for relief well drilling and cap installation. A contract is currently in place between STO and AMOSC (Australian Marine Oil Spill Centre) for the use of the SFRT.
Oil Spill Response Limited Provision of (1) Oil spill response equipment and personnel; and (2) Operational and Scientific Monitoring (OSM)	Duty Manager (Asia Pacific)	+65 6266 1566 dutymanagers@oilspillresponse.com		+65 6266 1566
The Response Group (TRG)	TRG Duty Officer 24/7 Designated call-out authorities (all Incident Commanders) Arrangements with TRG for the provision of trained field response personnel	00 11 1 281 880 5000		00 11 1 281 880 5000
RPS	RPS Response Duty Officer 24hrs	0408 477 196 rpsresponse@rpsconsulting.com	0408 477 196	0408 477 196

North West Alliance	Primary Contact Mitchell James Contract Delivery Manager Secondary Contact Nikolai Panine – Operations Manager NWA Regional Manager – TBA NWA Centralised Admin	 132 955	0437 013 114 mitchell.james1@northwestalliance.com 0409 710 067nikolai.panine@northwestalliance.com	
Veolia Darwin (for NT)	Primary Contact Person (Project Manager) - NT Operations Manager - Nick Walker Secondary Contact Person - NT Fleet Manager - Angela Maisey Location Responsible Person /Ops Supervisor: Justin Vicary Brian Gehringer		08 8947 8947 nick.walker@veolia.com 0409 328 052 angela.maisey@veolia.com 0431 218 847 0497 791 388	
Global Spill & Safety		1300 774 557		
Perth Petroleum Services Oil & Chemical Spill Equipment		08 9258 5877		
Fast Wave – Tracking Buoys			+61 8 6460 700 +61 419911047 admin@fastwave.com.au	
Intertek Geotech (WA)		08 9263 0100 Reception		
Ecotox Services Australasia (NSW) (ecotoxicology)		02 9420 9481 (automated)		

Senversa (Need to contact if Oil Spill VI & AI Shore contact)	Jason Clay Senior Principal, Contaminated Sites Auditor (NSW and WA)	0410 431 674	jason.clay@senversa.com.au	
Tiwi Resources Ranger Coordinator (on behalf of Tiwi Islands Traditional Owners Clan Groups) Also notify: Tiwi Minupi Clan members (note:do not test these numbers): Dennis Murphy, Marius Puruntatameri Therese Bourke (Need to notify for actual or impending spills in NT waters surrounding the Tiwi Islands)	Verbal phone call notification - Verbal phone call within eight hours of incident being identified. Follow up with email outlining details of incident.	(Primary): 08 8941 1162 (Secondary): +61 403 047 221 (Katherine Whitehead) D.Murphy: 0458 481 889 M.Puruntatameri: 0475 435 925 T.Bourke: 0484 368 582	info@tiwiresources.com.au	
DFAT Global Watch Office (if oil spill has potential to contact another country)			globalwatchoffice@dfat.gov.au Monitored 24/7 and the staff monitoring DFAT will contact the relevant part of DFAT for a response	
Timor-Leste or Indonesian Specific Matters Please contact:			Joanne Lee (joanne.lee@dfat.gov.au) (Timor Leste0 and Robert Sutton (robert.sutton@dfat.gov.au) (Indonesia)	
City of Karratha	In the event of an emergency that may impact on the City's functions, interests or activities, please forward any correspondence direct to the CEO		ceo@karratha.wa.gov.au	

Shire of Ashburton	Given the potential for unplanned hydrocarbon release or discharge, the Shire requires Santos to brief the Shire's Local and District Emergency Management Committee's on its planned responses to such events before any activities commence.		emergency.management@ashburton.wa.gov.au	
Care of Hedland	Where Care of Headland's interests may be affected by an incident they must be advised.		coordinator@carefohedland.org.au	

7. WA & NT Oil & Gas Companies

Company	Position/Location	Phone	Mobile	After Hours
Chevron 250 St Georges Tce PERTH WA 6000	Barrow Island Port Controller - 24/7 Emergency Hotline	08 9184 3581		
	Incident Commander	0417 442 081		
	Emergency Management Adviser	0427 495 187		
	HES Specialist – Emergency Management & Oil Spill Response Jacob Hagan jacob.hagan1@chevron.com	0473 640 293		
	Main Line:	08 9216 4000		
	Chevron reservation number Megan Falaniko Lead Reservation Clerk	08 9485 5992 08 9485 5884		0448 130 087
Kufpec Australia Pty Ltd	Main Switchboard	08 9380 3900		
Vermilion	Main Perth number	08 9215 0300		
	Wandoo Platform – Field Superintendent	08 9215 0377		
	Wandoo Platform – Control Room	08 9215 0399		
	Wandoo Platform – Nurse/Admin	08 9215 0366		
Woodside Offshore Petroleum Pty Ltd	240 St Georges Tce Perth WA 6000 Woodside Communication Centre Marine Emergency Response Duty Officer Acting HSE VP – Adam Nicholas adam.nicholas@woodside.com.au Crisis & Emergency Management Manager – Dave Howell david.howell@woodside.com.au	08 9348 4000 (Main) 08 9348 4624 1300 833 333 (also can use 08 9348 7184) 0419 328 630 9348 5712 (ex 85712) 0418 919 151		1300 833 333
Shell Australia Ltd – Perth	Switchboard	08 9338 6600		
ENI Perth	HQ	08 9320 1111		
Jadestone Energy	General Duty IMT	9486 6600 0488 655 759		0488 655 759
BOC		08 8901 7817		
Bladin Facility		0417 726 812		

8. Medical Support

Company	Position/Location	Phone	Mobile	After Hours
Complete Corporate Health	Ascot clinic	08 9277 9900		
Santos Company Doctor Primary Clinical Advice – Santos in house Doctor (Emergency medicine background)	Dr David Crocker (Based in Sydney) Dr Lisa Walker Adelaide	02 8207 8477	0414 415 696 0411 898 692	0414 415 696
Dr Home Visit/ Deputising Dr		08 9321 9133		
Fremantle Hospital	Fremantle Hospital	08 9431 3333 *No Emergency Department*		
Fiona Stanley Hospital	Main	08 6152 2222 Emergency Dept – Open 24hrs		
	Hyperbaric Unit	08 6152 5222		08 6152 2222
Hedland Health Campus	Colebatch Way South Hedland WA 6722	08 9174 1000 Emergency Dept – Open 24hrs		
Karratha Medical Centre	Switchboard	08 9185 3555		Karratha Health Campus
Karratha Health Campus		08 9144 7777 – 24 hrs Emergency Dept – Open 24hrs		
Onslow Hospital		08 9184 3200 Emergency Dept – Open 24hrs		08 9184 3200
Exmouth Hospital	Lyon Street Exmouth WA	08 9949 3666 Emergency Dept – Open 24hrs		
	Dentist	08 9949 3690		
Queen Elizabeth II Medical Centre 7 Sir Charles Gairdner Hospital		08 6457 3333 Emergency Dept – Open 24hrs		08 6457 3333
WARAME – Aspen Medical Support Services	Switchboard 24 Hrs	Domestic : 1800 559 399 International : 02 6188 5548	Note: Post activation – ASPEN will provide relevant contact number for activating fixed wing, if required	

	Karratha Doctor	0408 172 439		
	Karratha Paramedic	0408 171 946		
	Service Delivery Manager (backup)	0409 447 057		
CPAG Medivac Support Hotline		1300 565 251		
Safety Direct Solutions (SDS)	Aero Medevac for Barossa	1300 702 737	Secondary +61 480 279 805	
International SOS	Assistance Centre	02 9372 2468		
Royal Flying Doctor Service	Main Number	08 9417 6300		
	Emergency only 24 Hr	1800 625 800 - State Wide calls 08 9417 6389 – Operations		1800 625 800
WA Health	Disaster Preparedness and Management Unit	0434 074 838 (Assistant Director) – Graham Stewart General Queries		Duty Manager 08 9328 0553 (Call this for an incident)
State Health Incident Control Centre (SHICC) [DoH (WA), 189 Royal Street, East Perth WA 6004]		08 9222 4444 (Operational only when stood up)	Emergencies on duty officer 08 9328 0553	
Royal Perth Hospital	Hotline	08 9224 2244 Emergency Dept – Open 24hrs		9224 2244
Poisons Information Centre		13 11 26		13 11 26
BSS EAP		08 9211 3700 1800 30 30 90		1800 30 30 90
Ambulance Central Control	Melbourne Central Control	03 9840 3500		1300 366 141 membership only
Devil Creek Ambulance Roebourne Hospital		08 9182 0200 Emergency Dept – Open 24hrs		
St Johns, Karratha	Admin Ambulance	08 9185 1222		000 – 24hrs
Bayu-Undan	CPAG - 24 Hour Medical (Request on call Doctor)	1300 133 624		
Timor Leste	Stamford Médical, Derek Chua	Emergency number Dili 00 11 670 7772 1111 00 11 670 331 0141 office hrs	Mobile (TL) 00 11670 7743 4980	00 11 670 7772 1111
Darwin	Royal Darwin Hospital	08 8922 8888		
	Darwin Private Hospital	08 8920 6011		
	Palmerston Regional Hospital	08 7979 9200		
	Palmerston GP Super clinic	08 8919 8919		
	Darwin Nursing Coordinator –	0401 116 415		

	Heli pad			
	St Johns Darwin	000 Office 08 8922 1503 or 08 922 6200		
Careflight Emergency Tasking – NT (can handle north WA by try RFDS first)		(1300 070 919) NT Ops Or 1300 655 855 1300 650 654 coordination unit Senior Coordinator 0417 826 336		

9. Aircraft Services

Company	Position/Location	Phone	Mobile	After Hours
Aerotech First Response (Fixed Wing Aerial Dispersant Capability – pilots, loading crew, liaison officer)	Kent Town, South Australia	08 8132 0400 08 8132 0999		In a response activate through AMOSC Duty Officer or AMSA RCC
AMOSC (Fixed Wing Aerial Dispersant Capability – Dispersant Operations Coordinator)	Via AMOSC Duty Officer		0438 379 328	0438 379 328
AMSA (Fixed Wing Aerial Dispersant Capability – Air Attack Supervisors, Liaison Officer)	AMSA Rescue Coordination Centre	1800 815 257		1800 815 257
Cobham (National Jet Systems)	Perth	9479 9700		
	Emergencies	1800 605 182		
	OCC Duty Manager	08 8154 7444	0431 729 886 Roy Frost	
Karratha Flying Services	Karratha Airport	08 9144 2444		0482 509 728
	Manager on Call	08 9144 2444		
	CEO	08 9144 2444		
	Senior Base Pilot Kris Dunctan		0450 655 528	
Polar Aviation	Port Hedland Airport	0419 955 210		
CTM Travel Tool	Bookings Onshore	Monday - Friday 8am - 6pm (AEST time zone) Phone from Australia: 1800 805 625 Phone from O/S: +61 9216 7200 santos@travelctm.com Emergency/After Hours Support (travel within 24 hours): Phone from Australia: 1800 805 625 Phone from O/S: +61 9216 7200 Sharepoint link		
	Bookings Offshore	Domestic/International/Trans Tasman Travel Booking Support: Monday - Friday 8am - 6pm (AWST time zone) Phone from Australia: +61 8 9216 7296		

		santoswa@travelctm.com Emergency/After Hours Support (travel within 24 hours): Phone from Australia: +61 8 9216 7296 Phone from Australia: 1800 805 625 Phone from O/S: +61 8 6467 2100		
RAAF	National 24 hr	1300 333 362		1300 333 362 24Hr Aust Wide
Skippers Aviation skippers@skippers.com.au	Perth Airport	9478 3989 1300 729 924		0417 988 562
Alliance Airline	Perth Airport	General Manager 08 9373 0902 Operations Manager 08 9373 0919 Operational Control Centre (1st point of contact) 07 3212 1532	Russell Bryant 0438 738 321 Lisa Armstrong 0439 949 500	
TNT Air Charter	Sydney	13 11 50 – 24Hr		
Offshore Services Australasia	Head of Commercial	6316 4554 Graham Bowles	0428 121 578	
Offshore Services Australasia PTY LTD (Formerly Babcock Helicopters) (Karratha)	Karratha Operations 24 hours	08 9185 7684 Osa.ktachkn@chcheli.com Primary contact number is always 0455 432 001. There are times the desk phone will not be manned.	0455 432 001 (Main 24hr - Primary) 0439 948 466 (Ops PM)	0455 432 001
	24h Medivac	Aspen 1800 559 399		
	Karratha Check In (Menzies)	0437 090 962 OSA.KTACHKN@chcheli.com		
PHI Helicopters	BD & Contracts Manager	Jade Turner 0477 220 633		
	Commercial & BD Director	Gordon Watt 0477 221 147		
	Broome Base Manager	Ric Collins 0477 110 335		
	Onslow Base Manager	0499 162 444		

	Regional Operation Centre - Perth	0447 431 906 (24/7) 1300 727 469 (24/7)		
Weststar – Dili Helicopters 24/7/365 Numbers	Base Manager – Primary Contact	+670 7509 6945 timorleste.bm@weststar-aviation.aero		+670 7509 6945
	Alternative Contacts if required			
	WestStar Flight Operations	+670 75980596 philip.tan@weststar-aviation.aero azizie.mamat@weststar-aviation.aero		+670 75980596
	WestStar Chief Pilot	+670 75155158 timorleste.cp@weststar-aviation.aero		+670 75155158
	Weststar Base Chief Engineer	+670 75083483 timorleste.bce@weststar-aviation.aero		+670 75083483
Timor Leste Aviation Navigational Administration (ANATL)	Point of Contact: Suai Airfield ANATL Director - Filomena Maria da Costa Soares	+670 – 7317 2036 dacostasoaresfilomenamaria@gmail.com		
CHC Helicopters Karratha	Karratha Base Manager	08 9185 7606	0420 773 411	0420 773 411
	CHC Duty OPSO		0429 374 243	0429 374 243
	24h Medivac		Aspen 1800 559 399 0409 447 057	
			08 9185 7601 Ops Landline	
Shire of Exmouth	Airport & Heliport			
	Airport Manager	08 9949 1326 0427 744 153 - 24/7		9949 1326 diverts to 0427 949 419 Duty ARO
	Learmonth Heliport Check-in	08 9949 1875		
	Exmouth Heliport Ops	08 9949 3000		
Shire of Ashburton	Onslow Airport	08 9153 2000		0487 654 272 after hours on call
Pilbara Transit Service/Land, Air, Sea Transport Solutions LASTS Transit	Dampier	0427 831 755 Operations 1800 527 878		
Darwin Airport Control Tower	Duty Approach Supervisor	08 7929 4817 08 7929 4816		
Air Traffic Control (Air services) Melbourne Air Services (FRI) Own air space	Perth Air Traffic Control	9476 8620 - 24 hr Tower – 9476 8625		
	Air service – Ops Director	03 9235 7420		

		Melbourne after 50 km out of Perth		
	Air services – Systems Specialist	03 9235 7402		03 9235 7402

10. Marine Vessel Services

Company	Position/Location	Phone	Mobile	After Hours
ABS 24/7 Casualty Response Program	ABS Rapid Response Damage Assessment	+1 281 820 8697 +1 281 877 6737		rrda@eagle.org
Bhagwan Marine	Primary Contact Managing Director - Loui Kannikoski	08 9424 2300	0418 939 177	
	Secondary Contact General Manager – Operations – Tom Kannikoski	08 9424 2307	0409979551	
Dof Management	Primary Contact General Manager – Clint Rhodes	08 9278 8700	0438 975 721	
	Secondary Contact Commercial Manager – Tim Jeffery	08 9278 8700	0400 699 876	
Jetwave Marine Services	Primary Contact General Manager – Nik Smith		0427 913 438	
	Secondary Contact Commercial Manager – Mani Bajwa		0490 941 381	
	Jetwave Asari	08 6218 7576	0439 935 231	asari@jwms.com.au
	Jetwave Lightning		0455 516 001	lightning@jwms.com.au
GL Noble Denton	Senior Surveyor	08 9215 4600	0408 533 222	
Laloran	**See Go Offshore contact details below.			
Lloyds Register Fremantle	Senior Surveyor	08 9318 7318 08 9318 7328	0409 691 003 0412 467 335	
	Secondary	08 6436 1466	+61 476 826 368	
MMA Offshore	Primary Contact Chartering Manager – Mike Merrutia	08 9431 7431	0417 913 985	
	Duty Phone		0408 913 988	
	24hr Emergency Contact		0417 915 566	
Sea 1Offshore	Primary Contact Operations Manager – Aaron Barbetti		0436 812 428	
	Secondary Contact General Manager – Craig Roberts		0408 423 689	
Solstad Offshore	24 Hour Emergency	08 9421 9316		

Company	Position/Location	Phone	Mobile	After Hours
	Primary Contact Managing Director	08 9421 9317	0427 226 444	Stewart.massey@solstad.com
	Secondary Contact Operations Director - Joel Mullins	+61 8 9421 9315	+61 40095 8778	
Tidewater	Commercial Manager - Thibault Thiery Operations Manager – Deon Prinsloo	(+65) 6309 3705	(+65) 8121 5749 0448 627 984	
Gun Marine	PRIMARY Marine Operations & HSSE Skyla Grant	08 9949 4646	0429 049 458	
	SECONDARY Director – Mike Forde		0417 733 329	
GO Offshore	PRIMARY General Manager Operations Lee Seubert	08 9474 3600	0458 020 013	
	SECONDARY Commercial Manager – Victoria Sullivan	08 9474 3600	0447 020 008	

11. Road Transport

Company	Position/Location	Phone	Mobile	After Hours
Toll Energy	Forrestfield			
	Operation Manager Nathan Tuckey		0438 174 032	
	Supply Chain Lead Craig Mollica		0497 359 329	
	Dampier			
	Business Unit Manager Clint Cork	08 9185 7021	0400 385 631	
	Operations Manager Adam Gallash	08 9183 6648	0419 537 507	
Independent Fuel Distributors DC Condensate Transport Specific	Director Mark Lindsay	91826300	0412956413	
	Operations Manager Ron Halliwell	08 91826330	0439626989	
Deugro (International Freight Forwarding)	Account Manager – Tui Pursell		+61 497 440 757	
	Project Forwarder – Verity Hammond		+61 431 183 400	
	Key Account Manager – Crystal Chua		+61 407 196 243	

Company	Position/Location	Phone	Mobile	After Hours
Exmouth Freight and Logistics	Shane Coote Shane@exmouthfreight.com.au		0438 417 131	
	Simon Pember operations@exmouthfreight.com.au		0439 517 670	
	On-call Duty Supervisor		0475 510 900	0475 510 900
Santos Offshore Santos logistics and storage base. Collection depot prior to cargo heading North. Coordinate collection as well as loadout/backload of cargo/equipment	Forrestfield			
	Logistics Team Leader		0467 740 440	Simon Kisch
	Logistics Improvement Analyst	6218 7782	0438 641 864	Paul Arnold
	Dampier			
	Supply Base Supervisor	6218 7827	0457 631 010	John Ziolkowski
	Production MLC	6218 7836	0439 679 616	Lance Chapman

12. Police and Security Services

Company	Position/Location	Phone	Mobile	After Hours
Police - Australia		000		
WA Police Karratha Police Station (24 hrs 7 days a week		(08) 9143 7200/22 (08) 9143 7207 Shift Sergeant		
DBCA Rangers Barrow Island		08 9182 5095		
Exmouth Police Station		(08) 9947 8700 Mon – Fri 8am-4pm After that phone 131444 or Karratha Police Station		
Northern Territory Police, Fire & ES (Non-Emergency)		(08) 8922 1583 or 08 8922 1522		
Northern Territory Water Police		P: 131444 (Police Response) Ask to speak to Officer in Charge NT Water Police		
Department of Home Affairs (Border Watch) (Use this number for breaches of 500m security zone)		1800 009 623 (only available in WA from 7.30am to 3.30pm) (or + 612 6246 1325 if calling from overseas or using a satellite phone)		
Office of Transport Security Aviation/Maritime – O&G Coordination Team (CISC – reporting incidents as defined by OFSPs)		1300 791 581		
Australian Security Intelligence Organisation (Public line) Out Reach		13ASIO – 13 27 46 (02) 6234 1668		
National Security Hotline (covers ABF/AFP – DoHA)	24hr number	Tel: 1800 123 400 Within Aus +61 1300 123 401 Outside Aus		

Company	Position/Location	Phone	Mobile	After Hours
		SMS only – 0429 771 822		
Australian Border Force (Emergency Visas)	For URGENT medivac and travellers does not have a visa to travel, you MUST contact our Border Operation Centre (BOC - boc@abf.gov.au) for uplift approval; cc'd paxmanintell@abf.gov.au and borders.nt@homeaffairs.gov.au Relevant info and documents required when seeking approval from BOC, for example: 1. Patient medical and passport information 2. Hospital acceptance letter 3. Guarantee of payment letter for hospital expenses 4. Copy of patient passport	Emails to right in afterhours column are the first option. Lillian Ong Supervisor Aviation Operations – Border Operations Operations North P: 08 8901 6231 E: lillian.ong@abf.gov.au Ph: 08 8920 2552 (general)		These emails are monitored 24/7 by 4 separate aviation teams. boc@abf.gov.au cc'd paxmanintell@abf.gov.au and borders.nt@homeaffairs.gov.au

13. Gas Customers

In the event of an incident that has the potential to affect gas supply

For DLNG/Bayu/Barossa Domestic gas supply impacts, please use: East Coast Duty Phone (24hrs): +61 08 7081 1110 | gasrep@santos.com

For WA Domestic Gas supply impacts, please use: West Coast Duty Phone (24hrs): +61 08 6186 1000 | wamarketing@santos.com

Appendix 1 Satellite Phone Dialling Pre-Fixes List

Satellite Phone Dialling Prefix List

Calling From: **Fixed Sat Phone**	Calling To: **Fixed Sat Phone**
Dial 00, then the number Eg. To call CCR fixed sat phone dial 00 870 776 624 043	
Calling From: **Fixed Sat Phone**	Calling To: **Mobile Phone**
Dial 00618, drop the first 0, and dial the rest of the number Eg. To call mobile dial 00618 421 840 371	
Calling From: **Fixed/Portable Sat Phone**	Calling To: **Landline**
Dial 00618, then the number Eg. To call CCR dial 00618 6218 770	
Calling From: **Fixed/Portable Sat Phone**	Calling To: **Portable Sat Phone**
Dial 0061, drop the first 0, and dial the rest of the number Eg. To Call CS1 portable sat phone dial 0061 147 144 779	
Calling From: **Portable Sat Phone**	Calling To: **Mobile Phone**
Dial 0061, drop the first 0, and dial the rest of the number Eg. To call mobile dial 0061 421 840 371	
Calling From: **Portable Sat Phone/Landline/Mobile Phone**	Calling To: **Fixed Sat Phone**
Dial 0011, then the number Eg. To call CCR fixed sat phone dial 0011 870 776 624 043	
Calling From: **Landline/Mobile Phone**	Calling To: **Portable Sat Phone**
Simply dial the number Eg. To call CS1 portable sat phone dial 0417 144 779	